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Thomas A. Edison Papers

A SELECTIVE MICROFILM EDITION

PART II
(1879–1886)

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1987

Thomas A. Edison Papers
at
Rutgers, The State University
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18 June 1981

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THOMAS A. EDISON PAPERS

A SELECTIVE MICROFILM EDITION
PART II
(1879-1886)

REEL 96

COMPANY RECORDS SERIES (COM-I)

COMPANY RECORDS SERIES

Two sets of documents comprise the Company Records Series for 1879-1886: (1) Primary Printed Collection; (2) Miscellaneous Company Records.

(1) Primary Printed Collection. This collection contains printed documents that were issued by the various Edison companies and their competitors. Most of the items are advertising circulars, promotional brochures, and instruction manuals. A few other items such as annual reports, company bylaws, and incorporation papers are also included. All of the printed material issued by the Edison companies has been filmed except for duplicate copies of selected documents.

(2) Miscellaneous Company Records. This collection consists primarily of minute books, bulletins, canvass books, and other bound items relating to the various Edison companies. Included among the documents for 1879-1886 are extensive runs of the bulletins issued by the Edison Electric Light Company and the Edison Company for Isolated Lighting.

The documents appear on the microfilm in the following order:

PRIMARY PRINTED COLLECTION

A. Electric Light Companies - Domestic

1. Edison Electric Light Company
2. Edison Company for Isolated Lighting
3. Edison Electric Illuminating Company of Brockton
4. Edison Electric Illuminating Company of New York
5. Western Edison Light Company

B. Electric Light Companies - Foreign

Europe

1. Edison Electric Light Company of Europe, Ltd.
2. Compagnie Continentale Edison
3. Societe Electrique Edison
4. Societe Industrielle & Commerciale Edison
5. Deutsche Edison Gesellschaft

South America

Compania Electrica de Edison

C. Other Companies

1. Edison Phonoplex System
2. Edison Speaking Phonograph Company
3. Edison Telephone Exchanges
4. Gold and Stock Telegraph Company
5. Menlo Park Manufacturing Company
6. Sims-Edison Electric Torpedo Company
7. United Telephone Company, Ltd.

MISCELLANEOUS COMPANY RECORDS

A. Electric Light Companies - Domestic

1. Edison Electric Light Company [bulletins]
2. Edison Company for Isolated Lighting [bulletins]
3. Edison Electric Illuminating Company of Boston [finding aid to microfilmed collection of letterbooks and other records]
4. Thomas A. Edison Construction Department [instruction books, engineering plans, canvass books, other records]

B. Electric Light Companies - Foreign

1. Edison Electric Light Company of Europe, Ltd. [scrapbook]
2. Edison Electric Light Company, Ltd. [agreements, incorporation papers, lists of stockholders]

C. Other Companies

1. Edison Ore Milling Company, Ltd. [minute book]
2. Edison Telephone Company of Europe, Ltd. [minute book, stock certificate book, stock transfer book]

Edison Electric Light Company

This folder contains printed material issued by the Edison Electric Light Company. This company was established in late 1878 to provide Edison with funds for his experiments in electric lighting in return for control of any patents he might receive in this field. The company licensed these patents to subsidiary companies like the Edison Machine Works and Edison Electric Illuminating Company of New York. These manufacturing and operating companies built and sold electrical equipment and constructed central stations, while paying royalties to the Edison Electric Light Company.

The following items have been filmed:

1. Annual Report (1885)
2. Annual Report (1886)
3. "The Edison Central Station System" [second edition] (1885)
4. Central Station Catalog (1886)
5. Testimonial from the Laramie Electric Light Company (1886)

The following items have not been filmed:

1. "The Edison Central Station System" [first edition] (1884?)
2. "The Edison Electric Light Meter" [This pamphlet also appears as an enclosure to a letter from Francis Jehl to Edison, May 11, 1882, D-82-039 (Document File Series).]

EL. LT. - E. El. Lt. Co. - Reports D-147
851027

THE EDISON ELECTRIC LIGHT COMPANY.

REPORT

OF THE

BOARD OF TRUSTEES

TO THE

STOCKHOLDERS,

AT THEIR

ANNUAL MEETING,

OCTOBER 27TH,

1885.

NEW YORK:
C. G. BURGOYNE'S "QUICK" PRINT, 146-150 CENTRE STREET,
1885.

BOARD OF TRUSTEES.

EXECUTIVE COMMITTEE.

OFFICERS.

GENERAL OFFICES,
65 Fifth Avenue, New York City.

To the Stockholders of

The Edison Electric Light Company:

Since the last annual report of your Trustees, your Company has passed through an important and gratifying year, and at its close the outlook for a prosperous future is clearer and rests on a better foundation than at any time in its history.

The predictions made in past years that the Edison Light had come to stay have been amply verified, and each successive year shows more conclusively its superiority over other present known methods of artificial illumination, and proves that it is able to stand the test of time.

The first isolated dynamo sold by your company was started May 2, 1880, and the first central station, that of New York, Sept. 4, 1882. In these, as in all subsequent installations of isolated and central station plants, The Edison Light has gained favor, and is now more popular with those who use it than when the light was first turned on. Indeed it is a remarkable fact that the plant above referred to as being the first isolated installation, is in perfect working order to-day, although marked changes and improvements have been made in the manufacture of our dynamos and electrical appliances, as well as in our general system of electric lighting since that time.

All of our various interests have associated with them the best obtainable electrical and mechanical engineers, whose aim has been to simplify and cheapen our system of electric lighting, and as a result of this combined experience

and effort, little remains to be desired in our system of central station and isolated lighting of to-day.

During the year, 14 central station companies have been organized, viz.: Harrisburg, Pa., Des Moines, Ia., York, Pa., West Chester, Pa., Tamaqua, Pa., McKeesport, Pa., New Brunswick, N. J., Wilmington, Del., Boone, Ia., Johnstown, Pa., New Bedford, Mass., Lockport, N. Y., Little Falls, N. Y., Jackson, Mich.

There are now 31 central station plants in operation or in course of installation in the United States, a complete list of which is given below:

Location.	Capital.	Lamp Capacity.
* New York City	$1,000,000	18,000
* Lawrence, Mass	65,000	8,200
* Brockton, "	65,000	4,000
* Fall River, "	90,000	8,080
* Newburgh, N. Y	45,000	1,000
Shamokin, Pa	27,000	2,400
Sunbury, Pa	20,000	500
Hazleton, Pa	25,000	1,000
Williamsport, Pa	100,000	1,000
Harrisburg, Pa	100,000	5,000
Bellefonte, Pa	16,000	800
Ashland, Pa	20,000	1,000
Appleton, Wis	25,000	800
Cumberland, Md	50,000	1,000
Piqua, Ohio	40,000	1,000
Middletown, Ohio	20,000	1,000
Tiffin, Ohio	40,000	1,000
Circleville, Ohio	30,000	1,000
Des Moines, Iowa	80,000	3,800
West Chester, Pa	30,000	1,500
New Bedford, Mass	50,000	2,000
McKeesport, Pa	100,000	1,000
Tamaqua, Pa	50,000	1,000
New Brunswick, N. J	50,000	1,000
York, Pa		1,000
Wilmington, Del		1,000
Boone, Ia		600
Johnstown, Pa		2,000
Lockport, N. Y		400
Little Falls, N. Y		500
Jackson, Mich		500
Total Lamp Capacity		63,480

The plants marked * have underground conductors; the others have pole lines.

The Edison Electric Illuminating Company, of New York, has been earning, for the six months ending October 1st (which are all summer months), at the rate of four and a half per cent. per annum, and on August 1st of the present year, paid a first quarterly dividend of 1% to its stockholders, and another of like amount has been declared for the quarter ending November 1st. This company is now on a firm financial footing, reached under extraordinary difficulties.

As stated in our last annual report, this was the pioneer central station, and like most pioneer enterprises, it was subjected to peculiar difficulties at almost every point. The most serious of them was, of course, the great cost of installing the plant, which was so far in excess of the very imperfect estimates which could then be made, that the entire resources of the company were not only consumed, but it was left with a heavy floating debt, to embarrass it in its operations. It is peculiarly gratifying, therefore, to be able to state that the company has at last succeeded in discharging that debt, and is now paying moderate and regular dividends, with a certainty of increasing them as soon as the capacity of the station is enlarged.

The following extract from the letter of the Treasurer of the Illuminating Co. of New York, dated July 17, 1885, to its stockholders, announcing the quarterly dividend, the same being an extract from the minutes of the Company, will show its position to be a strong one:

"The president then exhibited a detailed report of the earnings and expenses of the company, showing that the net earnings for the six months ending June 30, 1885, after paying all expenses of every description, were $25,666.90."

"The president further stated that the Company is absolutely free from floating debt of any kind, the debt incurred in increasing the capacity of the Pearl Street Station having been entirely paid from earnings, and that after such payment, and after payment of all outstanding accounts for current supplies, &c., there remained from earnings, a sum of $10,589.40 cash on hand applicable to dividends."

The Treasurer then adds:

"For your further information, I may state that the long pending questions between this Company and the Edison Electric Light Co., arising from the excessive cost of the Pearl Street Station, as originally installed have at last been settled in a manner satisfactory to your Board by the deposit by the Light Co., in trust, of 1712 shares from the stock of your Company heretofore held by it, the stock so deposited to be used in promoting the installation of an uptown station, and meanwhile, to forego all claims to dividends; consequently dividends are payable on only 8,388 shares of stock, upon which the earnings of the last six months are at the rate of 6% per annum."

Your Trustees deem it a matter for congratulation that the claims of the Illuminating Co. of New York, against your Company, have been amicably settled as above stated, by the surrender of part of the stock of the Illuminating Co., heretofore held by your Company, and the stock thus surrendered has been placed in the hands of three trustees, the trust deed providing that part or all of it may be used as an aid in securing the necessary funds for an uptown station.

The Trust deed further provides that in case the Illuminating Company does not within one year, from July 1, 1885, succeed in obtaining the sum of $500,000, and proceed with the installation of an uptown district, 1,000 shares of the said stock shall revert to your Company, and in the event of the Illuminating Company succeeding in raising the above sum of $500,000, your Company is to receive $125,000 of the increased capital, in payment of license for the new district.

The time has certainly come when another district should be occupied in New York. Careful and reliable estimates based on the results achieved by the down town district, show that a district installed uptown, with all the latest improvements, with present decreased cost of installing and operating, and in a location which is conceded to be much better lighting than the down town district, would return very handsome dividends from the start. There

is every indication that the money will be raised early this winter, and with the assistance given by the trust stock, before alluded to, your Trustees believe that success is assured.

The effect on the business of your Company of a second district in New York can scarcely be overestimated. It would, without doubt, give an impetus to the establishing of similar districts in other large cities, and be a wonderful stimulus to central station lighting throughout the country.

One of the most satisfactory of your licensee companies is that of Harrisburg, Pa. This plant has been recently completed, and the plan of construction as well as its perfect working is the admiration of all who see it.

An extract from the New York "Electrical Review," of June 20, 1885, relating to this plant, will be of interest:

"This company has been in operation about three months, and is reported to be on a dividend-paying basis from the start, a rather unusual thing. It generally takes a gas company a year to get their business on a paying business, and this has heretofore been the result with starting Central Electric Light Stations on the incandescent system. It has generally taken a long time to get customers to pay for wiring their stores, but this Company adopted another rule.

"They have paid for all the wiring themselves, simply requiring a contract for a year at so much a lamp, payable monthly. The average charge is seventy-five cents for a lamp (of sixteen candle power) a month, and the system is so popular that every lamp of their present capacity (3,500) is sold, and they have decided to enlarge their works. They have among their customers the lighting of the State Capital at $1,000 a month the year round, and have a three years' contract. In their present district there are twelve hotels, large and small. These have all discarded gas all over the house and use nothing but incandescent lights.

"These lamps can be lighted at any time of the day or night, as the engines are always at work. With a few exceptions the Edison lamps are fitted to the old gas fixtures, and the average expenses to the company [i e cost of wiring] have been about $2.50 per lamp. The popularity of the new light is so strong that without exception all the users have taken out their gas meters. * * * * * *

"In Harrisburg the wires are all overhead and a better working station cannot be found in this country. The electric light station is one of the best ever erected and situated among residences close to the State House. It is an ornament to the street and city. * * * * *

"It will pay any one interested in the success of incandescent lighting to visit Harrisburg and see the plant in operation."

Since the above was published the Harrisburg Company has increased the capacity of its station to 5,600 lights. They state that they are already earning over twenty-five per cent. on their capital stock, and expect to do still better.

The foregoing statement regarding Harrisburg is not in any way exceptional, and only fairly illustrates the great progress that has been made during the past two years in perfecting our central station system, not only electrically, but also commercially. In fact, it is from the commercial standpoint that the greatest progress has been made, for while the efficiency of our plant and method of installation, as adopted to-day, are in every way vastly superior to our earlier work, these facts in themselves would not be sufficient to enlist capital in this most important branch of our business. Your Company has therefore striven earnestly to improve and develop the methods of central station installation on a sound *dividend-paying* basis, and it can now be stated emphatically that all our installations of the past year or more have proven to be profitable enterprises. The faults, electrical and financial, which characterized our installations of three or four years ago, are now happily things of the past; and with two or three exceptions, even these earlier installations have developed into prosperous and dividend-earning companies. In some cases, to bring this about, reasonable concessions have been made by your Company, and the wisdom of such a course must be so apparent that your Board does not deem any extended comment or explanation necessary. These concessions have been largest towards our Ohio Companies, which have been engaged in a hard struggle, forced upon them by the local gas companies, who evidently thought they could easily crush out electric lighting in their respective neighborhoods. The result, however, has been exactly opposite to such anticipations, and in one case, already, the gas company has succumbed, and the Electric Company now controls the business.

The most important event of the past year has been the bringing of suits at law by your Company against the principal infringers of your lamp and other patents.

The expediency of bringing such suits was suggested in the last annual report, and as subsequent events confirmed the fact that longer delay would be imprudent, steps were taken to bring immediate actions against the infringers. We are now able to report that on May 2, bills of complaint were filed against the United States Electric Lighting Co., The Consolidated Electric Light Co., The Swan Incandescent Electric Lighting Co., and a number of consumers of light furnished by companies infringing your patents.

Great injury is being done your Company and all its licensees, by these infringers on Mr. Edison's ideas and inventions, all of which we believe to be fully protected by your patents, and your Board are resolved to vigorously prosecute and stamp out all infringements, and to seek the aid of the Courts in maintaining the patents that belong exclusively to you by priority of invention and right.

The services of Hon. Wm. M. Evarts have been secured as advisory counsel; and Messrs. J. C. Tomlinson and R. N. Dyer have been engaged to carry on the active preparation and prosecution of the suits. We believe that with these gentlemen your patent matters are in good hands, and we have full confidence that the suits will be brought to a successful issue as expeditiously as possible. Our solicitors are serving notices of infringement from time to time on parties who are using or who may have begun the manufacture of lamps infringing the Edison patents, warning them against their manufacture or use. These notices are having a good effect.

The many vexed questions arising out of past business transactions between your Company, Mr. Edison, and the various shops, as well as certain claims of Mr. Edison under

his contract with this Company, were made the subject of investigation by a special committee appointed by the Board and the result has been a settlement of these long pending differences by mutual compromises in a manner satisfactory to all the parties concerned. Under Mr. Edison's interpretation of his contract your Company would have been obliged to pay him the sum of $100,000 in cash; but against such payment various reasons and offsets were urged and the matter was finally settled by allowing as due to Mr. Edison the sum of $66,755.70 with provision however that same shall not be called for until such time as your Company shall reach a dividend-paying basis. It is but just to Mr. Edison that your Board should bear testimony to the spirit of fairness which he displayed in the settlement of these vexatious questions which are now so happily adjusted.

An agreement has been made with the Sprague Motor Company allowing them to use several of our brush and armature patents in connection with their motor, thereby increasing the efficiency of the latter. As consideration for this privilege, the Motor Company agree to pay a royalty of 3% on the value of all motors sold to your licensee companies within their territory. This arrangement will benefit your Company by increasing the earning capacity of the licensee companies in which you are stockholders.

Reference was made in the last annual report to the arrangement made by your Company with the Edison Co. for Isolated Lighting, whereby the latter assumed the direction of the canvassing and exploitation of central station business. As explained in the last report, the Isolated Company was already provided with an efficient corps of agents and electrical engineers quite adequate to carry on this work in connection with the isolated and village plant business conceded to them under their

original contract with your Company. By the the transfer of this part of our business to them, your Company is relieved of the necessity and responsibility of carrying a department of trained experts and agents, while at the same time the central station system is being more energetically developed and extended.

In the business of isolated lighting the Isolated Co. has met with very keen competition from the various infringers on our patents, who, finding they could not benefit themselves, have endeavored to do all the harm they could to the business of the Edison Company. In pursuing this course, they have reduced prices to the bare cost of manufacture and installation; and while the Isolated Co. has never taken the initiative in this disastrous warfare, it has felt bound to meet the issue when forced upon it. Your Directors have many reasons for believing, that this policy has entailed heavy losses on our competitors, while the Isolated Co has not only maintained its prestige and secured the bulk of the business, but it has also succeeded in holding its own financially. Sooner or later, the policy of doing business at cost must tire out these various guerrilla companies, if, indeed, their operations are not sooner checked by the enforcement of our patents; and there is no reason to doubt that isolated business will then be more profitable.

The arrangement made a year ago with the Isolated Co., as above stated, has resulted in very materially lessening the expenses of your Company. Great care has also been exercised to avoid unnecessary outlays, so that your Trustees are enabled to report a marked decrease in expenses as compared with former years, the expenses for the past year having been reduced by nearly one-half as compared with the preceding year. On the other hand, the income of your Company from dividends and cash licen-

ses has steadily increased, and it is not improbable that the coming year will be the turning point in the history of the company, when income will equal or exceed expenses and your Company be self-sustaining.

There is already in our treasury or due, $652,379.25 of stock in licensee companies, made up as follows:

New York	$100,000 00
Edison Co. for Isolated Lighting	383,409 25
Shamokin	4,320 00
Brockton	15,450 00
Newburgh	8,100 00
Fall River	18,000 00
Lawrence	10,025 00
Circleville	4,800 00
Appleton	3,200 00
Bellefonte	4,800 00
Cumberland	8,500 00
Hazleton	4,950 00
Des Moines	18,000 00
York	6,800 00
Harrisburg	20,000 00
Ashland	4,000 00
Piqua	4,000 00
Middletown	4,000 00
Tiffin	8,000 00
West Chester	4,000 00
McKeesport	13,125 00
New Brunswick	10,000 00
	$652,379 25

This, of course, will be augmented from time to time by stock received from new companies as they are organized.

It must be remembered, however, that four-fifths or more of the amount received by us for licenses to sub-companies is in stock, and with new companies some time must necessarily always elapse before any income can accrue to your Company from dividends. As all of your licensee companies are doing well and indicate excellent earning capacity in the near future, it is plain that at no distant day our income from

them will be very large. Many of them have already paid, and nearly all have earned dividends. In order, however, to encourage some of the earlier stations, your Company has allowed them to apply their profits to increasing their plant, thereby augmenting their earning capacity and permanently adding to the value of the stock held by your Company.

The superiority of the Edison lamp above all others was fully demonstrated at the Franklin Institute test in Philadelphia, concluded last spring. The Edison company submitted 21 lamps. The United States Co. (Weston) 20. Westinghouse (Stanley) 20, and Woodhouse & Rawson 11.

The committee appointed by the Franklin Institute, and who had charge of the test at first replaced broken lamps as they gave out with new ones. One lamp of the Edison, four of the United States Co., and two of the Westinghouse Co. were thus replaced, but the committee finding that all lamps but the Edison were giving out so rapidly, concluded that it was not worth while to substitute new lamps for those broken. The final result of 1,065 hours' continuous burning was as follows:

Edison Lamps, 1 broken out of	21
Weston " 17 " "	24
Stanley " 19 " "	22
Woodhouse & Rawson Lamps, all broken out of	11

Thus the great superiority of the Edison Lamp above all others was scientifically and practically demonstrated.

The question of the legal necessity of calling in the balance of increased capital stock, authorized Sept. 24, 1883, having been submitted to the General Counsel of the Company, your Board were advised by him that in order to comply with the requirements of the statute the full amount

of subscriptions should be called in within two years from the date of increase. Acting upon this opinion, your Board directed the Treasurer to call the remaining unpaid subscriptions to be payable Sept. 22, which has been done, although the financial condition of the Company did not necessitate the call.

The present authorized capital of the Company, viz., $1,080,000, will therefore be full paid as soon as all payments on the last instalment are collected.

A profitable field for the extension of the business of our local Companies has been found in street lighting. Until recently very little attention was given by us to the lighting of streets, mainly on account of the comparatively few lights used within large areas and long distances, which necessitated the use of heavy copper conductors, thus presenting a serious obstacle to the lighting of streets in an economical way. By the use of what is known as the "municipal system," as now applied by your licensee companies, a current of greater intensity is employed which permits the use of small conductors, and by placing the lamps in series economical and satisfactory results are obtained. This enables our licensee companies to compete successfully with arc light and gas, for street lighting, as well as for interior lighting.

As stated in the last report, the electric railway patents of Mr. Edison were assigned to the Electric Railway Co. of the United States, in which the Light Company has one-sixth interest, viz., $333,333.34.

Arrangements have been made with the Manhattan Railway Co., of New York, to conduct experiments on its Second avenue line of elevated railway, for the purpose of testing the practicability of the system of the Electric Railway Co., on the elevated roads in New York City. A third rail is now being laid on both tracks of the Second

avenue line, from Chatham Square to Harlem River, a total distance of about fifteen miles, and the car and motors for operation thereon, are now ready at the shops of the Edison Machine Works, whence they will be moved to the track as soon as the laying of the third rail is completed. It is then intended to conduct an extensive series of experiments and to demonstrate fully the great merit and economy that is believed to exist in our system.

The advance of our business in past years has been greatly retarded by our inability to refer to central stations that were earning money or paying fair dividends, for reasons given in reports of former years. Capitalists were naturally unwilling to invest money in any enterprise unless it was backed by good results, no matter how favorable the investment might appear prospectively. We can now point with pride to almost all of our central station companies, where financial success is an accomplished fact, and a visit to them inspires such confidence that it is becoming much less difficult to enlist capital to organize similar companies in other cities and towns.

In conclusion, your Trustees would say that nearly all the difficulties which have beset our path have been overcome, and we regard the future of the Edison Light and the success of your Company as assured.

The Balance Sheet of the Company to October 1st, 1885, is submitted herewith.

By order of the Board of Trustees.

EUGENE CROWELL,
President.

65 Fifth Ave., New York, Oct. 27, 1885.

EDISON ELECTRIC LIGHT COMPANY.

Dr.

Administrative Expenses:		
From Nov. 1, 1878, to date		$267,307 73
Experimental and Exhibition Expenses:		
Menlo Park and Laboratory Expenses	$160,187 54	
Experimental Dynamos	17,897 68	
General Experimental and Exhibition Expenses	98,800 72	
		276,885 94
Canvassing and Estimates		30,177 14
Patents:		
T. A. Edison	400,400 00	
Sundry Patents	7,501 89	
Patent Suits and Interferences	15,567 61	
Patent Fees and Expenses	75,095 10	
South American "	35,747 48	
Canadian "	26,030 86	
		561,542 89
Open Accounts:		
Electric Railway Co. of U. S.	22,270 58	
Sundry Accounts	6,350 40	
		28,620 98
Stocks and Bonds:		
Stock Edison Company for Isolated Lighting	255,909 25	
Stock Edison Electric Illuminating Co. of New York	100,000 00	
Stock other Edison Electric Illuminating Companies	100,845 00	
Stock Gramme Company	5,000 00	
Bonds Circleville Company	1,000 00	
Stock of our Company in the treasury, full paid	84,500 00	
		547,263 25
Cash		36,749 21
Bills Receivable		4,122 74
Sundry Property Accounts		14,310 36
		$1,766,980 24

CONDENSED BALANCE SHEET, SEPTEMBER 30, 1885.

Cr.

Capital Stock	$1,080,000 00	
Less due on Subscriptions	28,547 20	
		$1,051,452 80
Licenses:		
Licenses paid in Cash	$194,720 77	
" " " Stock	405,300 00	
" " " Bonds	1,400 00	
	$601,420 77	
Less Commissions to Agents	34,162 50	
		567,258 27
Income:		
From Stocks and Bonds	$42,689 45	
" other sources	3,565 97	
		46,255 42
Open Accounts:		
T. A. Edison Contingent Account	$66,755 70	
Sundry Accounts	765 98	
		67,521 68
Accounts and Bills Payable		34,492 07
		$1,766,980 24

E. & O. E.
New York, Sept. 30, 1885.

F. S. HASTINGS,
Treasurer.

THE EDISON ELECTRIC LIGHT COMPANY.

REPORT

OF THE

BOARD OF TRUSTEES

TO THE

STOCKHOLDERS,

AT THEIR

ANNUAL MEETING,

OCTOBER 26TH,

1886.

NEW YORK:
BURGOYNE'S "QUICK" PRINT, 146-150 CENTRE STREET.
1886.

To the Stockholders of the Edison Electric Light Co.:

The last two annual reports of your Trustees have explained to you so fully the early history and progress of this Company, in spite of its many and serious difficulties, that it is not now deemed necessary to go back to the beginning. The present report will seek merely to lay before you a summary of what has been done during the past year and of the present position of the Company.

In the last report, attention was called to the marked increase in the revenue of the Company and to the equally marked decrease in its expenses, and the opinion was expressed that the year now passed would be the turning point in its history when income would equal or exceed expenses, and the Company be self-sustaining. This prediction has been fully verified; all the expenses of the past twelve months, including heavy disbursements for patent litigation, have been provided for by the ordinary cash receipts of the Company, and there have been accumulated in its treasury all the stocks received for license rights granted the illuminating companies formed during the year, as detailed further on.

Out of the cash received for balance of our own capital stock, under the call referred to on page 16 of the last report, your Trustees resolved to create a special fund from which, except under extreme circumstances, no money should be used for the ordinary expenses of the Company, it being intended that all money in said fund should be reserved for expenses incurred in prosecuting our patent litigation. Happily the litigation expenses of the year have all been met without drawing on this fund.

It now contains :

$48,000 par value New York Central and Hudson River R. R. Co., 5% debenture bonds, worth to-day @ 108% $46,440 00
Loan on demand properly secured 6,000 00
Cash on hand 1,581 02

Total value of the fund $54,021 02

Several of our Central Station companies have increased the size of their plant since our last report; and new companies have also been organized as follows:

Name.	Location.	Lamp Capacity.
Reading Electric Light and Power Co.	Reading, Pa.	1,600
Chester Electric Light and Power Co.	Chester, Pa.	1,000
Edison Electric Light and Power Co.	Erie, Pa.	1,000
Edison Illuminating Co.	Detroit, Mich.	10,000
Edison Electric Illuminating Co.	Rochester, N. Y.	6,000
Edison Electric Illuminating Co.	Boston, Mass.	2,400
Forest City Electric Light and Power Co.	Rockford, Ill.	2,000
Elgin Edison Light Co.	Elgin, Ill.	1,000
Edison Electric Light and Power Co.	Amsterdam, N. Y.	1,920
Electric Light Co.	Atlantic City, N. J.	2,500
First Cincinnati Edison Electric Illuminating Co.	Cincinnati, O.	1,000
Wilkesbarre Electric Light Co.	Wilkesbarre, Pa.	2,400
Scranton Illuminating Heat and Power Co.	Scranton, Pa.	4,000
Edison Electric Illuminating Co.	Topeka, Kan.	2,400
Edison Electric Illuminating Co.	New Orleans, La.	6,000
Edison Electric Light and Power Co.	St. Paul, Minn.	10,000
Edison Electric Illuminating Co.	Altoona, Pa.	1,600

After deducting the amounts paid or payable to agents, your treasury has received from these companies, for illuminating license rights, $4,875 in cash, and $76,950 in their stock, and there is still due from them $21,900 in cash and $141,525 in stock, not including the amount coming from the Altoona Company, of which the capitalization is not yet determined.

The total of these receipts for the past year is equal to about 25% on our existing capital stock.

When the stocks above referred to are all received, our holdings of stocks of licensee companies will be as follows:

Name.	Location.	Stock.	Bonds.
Edison Electric Illg. Co. of	New York	$100,000	
do.	Lawrence, Mass.	10,925	
Appleton Edison Light Co.	Appleton, Wis.	4,400	
Edison Elec. Illg. Co. of	Shamokin, Pa.	4,320	
do.	Brockton, Mass.	15,450	
do.	Fall River, Mass.	18,000	
do.	Newburgh, N. Y.	8,100	
do.	Hazleton, Pa.	4,950	
do.	Bellefonte, Pa.	4,800	
do.	Cumberland, Md.	8,500	
do.	Ashland, Pa.	2,500	$800
Des Moines Edison Light Co.	Des Moines, Iowa.	12,000	
Harrisburg Electric Light Co.	Harrisburg, Pa.	10,500	
Edison Illg. Co.	Detroit, Mich.	37,500	
Edison Electric Light Co.	York, Pa.	6,000	
Edison Electric Illg. Co.	Westchester, Pa.	3,750	
do.	Tamauqua, Pa.	4,125	
McKeesport Light Co.	McKeesport, Pa.	13,125	
Edison Electric Illg. Co.	New Brunswick, N. J.	7,500	
Johnston Electric Light Co.	Johnstown, Pa.	4,500	3,000
Edison Electric Illg. Co.	New Bedford, Mass.	7,900	
Chester Electric Light & Power Co.	Chester, Pa.	9,375	
Edison Light Co.	Jackson, Mich.	16,000	
Boone Electric Light Co.	Boone, Iowa.	1,200	
Forest City Electric Light & Power Co.	Rockford, Ill.	6,000	
Elgin Edison Light Co.	Elgin, Ill.	3,600	
Edison Electric Lt. & Power Co.	Erie Pa.	11,250	
Edison Electric Illg. Co.	Boston, Mass.	25,000	
Edison Electric Lt. & Power Co.	Amsterdam, N. Y.	7,500	
Electric Light Co.	Atlantic City, N. J.	10,325	
First Cincinnati Edison Electric Illg. Co.	Cincinnati, Ohio	3,825	
Reading Electric Lt. & Power Co.	Reading, Pa.	5,100	
Edison Electric Illg. Co.	Rochester, N. Y.	18,750	
Wilkesbarre Electric Lt. Co.	Wilkesbarre, Pa.	9,000	
Scranton Illg. Heat & Power Co.	Scranton, Pa.	7,500	
Edison Electric Illg. Co.	Topeka, Kansas.	7,500	
do.	New Orleans, La.	22,500	
Edison Electric Lt. & Power Co.	St. Paul, Minn.	33,750	
Total stock of Illuminating Companies		$487,020	$3,800
Edison Co. for Isolated Lighting, full paid		256,100	
do. half paid		127,500	
Western Edison Light Co. (in trust)		100,000	
Electric Railway Co. of the U. S.		333,400	
Total stock and bonds of "Edison" Companies		$1,301,020	$3,800

In addition to the foregoing, there will be stock coming to us from the Edison Electric Illuminating Companies of Middletown, Circleville, Piqua and Tiffin, all of Ohio, our former holdings in these four companies having been temporarily turned over to the Ohio Edison Installation Company, under arrangements made with them some two years ago, for the support of these stations during a bitter conflict with the local gas companies, to which allusion was made on page 10 of the last report. It is a pleasure to state that three of these companies are now working on a profitable basis, and the fourth one is already self-supporting.

The stock which we formerly held in the Sunbury Company

has also been surrendered to encourage the other stockholders to put their plant, which was one of the earliest and most defective installed (over four years ago), in proper shape, and to increase its capacity. This has already been done, and it is believed that this concession which, under all the circumstances, was a just one, will be more than repaid whenever a further increase of the Sunbury station is made.

As so much of our own prosperity must depend on that of the licensee Illuminating Companies, whose stocks we hold, your Trustees have sought to collect and submit to you below detailed reports on the actual condition of some of the large Illuminating Companies organized and in operation up to date. Many of the recently organized companies, such as Rockford, Amsterdam, Atlantic City, Cincinnati, Wilkesbarre, Scranton, Topeka, New Orleans, St. Paul and Atloona have not yet begun, or are just beginning, operations, and reports from them consequently cannot yet be made.

Appleton Edison Light Co., Appleton, Wis.

Capital $50,000. Capacity 1,140 lamps of 16-candle power burning at one time.
Station started 1884.

Gross earnings, 6 months to August 31, 1884	$4,118 50
Operating expenses	2,054 94
Net earnings, 6 months	$1,463 56

Equal to 6% per annum on capital.

This company is now making an increase of its plant.

Edison Electric Illuminating Co. of Boston, Mass.

Capital $100,000. Capacity of station, 2,400 lamps of 16-candle power burning at one time. This station was nominally started early last spring; but owing to delays in wiring buildings, only a small number of lamps was

then connected. The operations of September, with 4,000 lamps connected were:

Gross earnings	$3,333 37
Operating expenses	2,271 91
Net profit for September	$1,061 46

At this rate the annual net earnings would be 12¾% on capital; but as 1,000 additional lamps have been connected during October, even better results may be expected. So well satisfied are the shareholders with the outlook for their property that they have recently subscribed to an increase of their capital to $250,000, and have directed that the capacity of the station be proportionately developed. The manager of the station reports that he has applications from customers for over 10,000 additional lights, a good part of which will be supplied by this increase.

Edison Electric Illuminating Company of Brockton, Mass.

THIRD ANNUAL REPORT.

CHARLES G. WHITE, President.
Directors—Chas. G. White, Arthur B. Denny, James P. Tolman, Frank J. Coburn, Fred. P. Richmond.

TO THE STOCKHOLDERS:

The results of the Company's third year of business, ending September 30th are herewith submitted:

Receipts for 12 months	$13,523 25
Running Expenses, including repairs, and interest	9,606 50
Net profits	$3,916 75

Comparative earnings for the three years:

1883-'84.	1884-'85.	1885-'86.
$6,634.10.	$12,835.06.	$13,523.25.

The results of the third year of the Company are herewith submitted to the stockholders. Its growth has been retarded by two disastrous strikes, injuriously affecting, for the time being, the prosperity of the city. Our output of lamps shows hardly any increase over that of the previous year, but our net receipts, notwithstanding, have increased twenty-three per cent. This is to be accounted for by greater economy of management and a more careful selection of customers. Our consumers numbered 188, September 30th, as against 135 a year ago. The station is in better condition than ever, and but $389.01 have been charged to construction account the past year. All money spent for repairs and maintenance of plant have been included in running expenses.

With the abatement of the labor trouble, and the consequent revival of prosperity in Brockton, and with a fresh demand for our light now manifesting itself, we may reasonably hope for better results during the fourth year of our enterprise.

Respectfully,
W. L. GARRISON,
Treasurer.

Brockton, Oct. 1, 1886.

BALANCE SHEET, OCT. 1, 1886.

ASSETS.

License	$16,500 00
Plant	61,972 96
Lamps, Oil, &c	442 85
Bills Receivable	1,644 89
Cash on Hand	926 50
	$81,487 20

LIABILITIES.

Capital Stock	$65,000 00
Bills Payable	12,570 45
Net Profit	3,916 75
	$81,487 20

BROCKTON, October 18th, 1886.

A dividend of two per cent. has been declared by the Edison Electric Illuminating Co. of Brockton, payable November 1st, at the office of the Treasurer, to stockholders of record October 15th.

W. L. GARRISON,
Treasurer.

Edison Electric Illuminating Co. of Cumberland, Md.

Capital $50,000. Capacity of station, 2,400 lamps burning at one time.
Station started September 1, 1884.

Gross earnings, 6 months ending August 31, 1886	$6,147 85
Operating expenses	4,492 16
Net earnings, 6 months	$1,655 69

Equal 6½ % per annum on capital.

The earning capacity of this station has been retarded by difficulties which have only recently been removed.

Harrisburg Electric Light Company, Harrisburg, Pa.

Capital $100,000. Capacity 6,300 lamps burning at one time.
Station started May, 1885.

This company has not furnished us with detailed figures of its operations. It has been very successful from the start, and for the past year has earned, we understand, about 23% on its capital. It pays dividends at the rate of 20 % per annum.

Edison Electric Illuminating Company of Hazleton, Pa.

Capital $31,000. Capacity 2,290 lamps burning at one time.
Station started February 11, 1884.

Gross earnings last 6 months	$3,754 06
Operating expenses	2,235 57
Net earnings, 6 months	$1,518 49

Equal to 10 % per annum on capital.

Johnstown Electric Light Company of Johnstown, Pa.

Capital $40,000. Capacity, 1,600 lamps burning at one time.
Station started February 14, 1886.

Gross earnings February 14, 1886, to August 31, 1886	$7,588 33
Operating expenses	4,085 29
Net earnings, 5 months, 14 days	$3,498 04

Equal to about 18% per annum on capital.

Edison Electric Illuminating Co. of Lawrence, Mass.

Capital $65,000. Capacity 4,490 lamps burning at one time.
Station started December 28, 1882.
This company reports profits for six months of $3,172.74, equal to 10% per annum on capital.

McKeesport Light Company of Alleghany County, Pa.

Capital $100,000. Capacity 1,000 lamps burning at one time.
This company reports earnings from March 1, 1886, to August 31, 1886, as follows:

Gross	$6,917 25
Expenses	5,204 52
	$1,712 78

Equal to $3\frac{1}{2}$% per annum on capital; but as the foregoing figures are for the summer months, they are no criterion of the year. According to the general rule in similar cases, the net earnings for its first year will be from 7% to 8%.

Edison Electric Illuminating Co. of New York.

Capital $1,000,000. Capacity (including annex station built August, 1886,) 9,500 lights burning at one time.
Started September, 1882. This was the first illuminating station ever

built. The light was supplied free until February 1st, 1883. The net result of operations since that date has been as follows:

1883, Net loss (11 months)		$4,467 50
1884, " profit		33,222 51
1885, " "		52,010 08
1886, " " To Oct. 1	50,118 75	
Oct. to Decr. (estimated)	20,000 00	
		70,118 75

The earnings of 1886 are equal to 7 % on capital.

This having been the first station ever installed, large sums were spent on experimental work and various mistakes were also made, necessitating subsequent correction at a heavy outlay. A new station of equal efficiency could be installed for not over $400,000, and the present net earnings are equal to $17\frac{1}{2}$ % on this sum.

Edison Electric Illuminating Company of Westchester, Pa.

Capital $80,000. Capacity 1,020 lamps burning at one time.
Station started October 1, 1885.

Gross earnings, March 1st, 1886, to September 1st, 1886	$5,784 92
Operating expenses	4,326 28
Net earnings, 6 months	$1,458 64

Equal to about 10% per annum on capital, based on the poorest six months in the year.

As may be gathered from the foregoing, the progress of our Illuminating Companies during the year has been very gratifying, and the outlook for the future is even more so. There are still a very few of the earliest companies which were defectively constructed, and which are not yet earning satisfactory dividends, but this condition is exceptional, and is being steadily overcome by better managment. The New York Illuminating Company, which was the forerunner of all others, is now in such prosperous condition that it is anxious and ready to install three large stations up-town at a cost of $1,000,000 or more. The money is practically secured under the trust arrangement set forth in our last report, and the necessary real estate for

two of the up-town stations has already been purchased and paid for; but the enterprise is blocked by the rather notorious Electrical Subway Commission, created by the New York Legislature, which Commission, while ostensibly appointed to put existing overhead telegraph and other wires underground, in reality refuses to grant to the Edison Company, which uses nothing but underground wires, the necessary permits to prosecute its work. The Commissioners seem to have entered into some arrangement with a so-called Construction Company, which is to monopolize the business by building a trench for all wires, and they say in substance that all companies must recognize this monopoly by putting their wires in its trench, of which the stability, when and if it is built, is at least questionable. And until this trench is built, the Edison Company is told that it must wait, and that its practical system of underground wires, which has stood four years' test, will not be permitted up-town, *nor will any system be sanctioned unless it comes into the trench and pays tribute.* So far this scheme has managed to keep just within the limits of the law, but the Edison Company believes that the outrage is now so flagrant that a mandamus against the Commissioners to allow it to put down its own conductors can be applied for with good prospect of success, and an early application to the Courts will be made.

The Illuminating Company, established several years ago at Santiago, Chili, which, owing to the extravagant manner of its construction and its unfortunate lack of a competent manager, met with many difficulties, has during the past year been re-organized on a sound working basis; and a payment of stock from it to your own company for license rights will shortly be made.

The business of street-lighting, or what is known as our Municipal system, to which reference was made in our last report, has developed considerably during the year, and after some preliminary difficulties, is now in successful use in Portland, Maine; also Denver, Col., Lockport, N. Y., and Seattle, W. T. In general it may be said that this valuable feature of our business has reached a practical footing.

The operations of the Isolated Company, while very large, have not been satisfactory. Competition in isolated plants must be expected until our patent suits are decided; and during the past year this competition has been so keen as to leave no money whatever in Isolated business; indeed, oftentimes sales have had to be made at less than cost. If any profit at all has existed, it has gone to the manufacturers, and your Trustees, together with those of the Isolated Company, have sought to have our manufacturing companies take charge not only of the making, but also of the selling of Isolated plants while this unsatisfactory state of affairs exists, on a basis of equity to all concerned. In this desire they were met most readily and fairly by the manufacturing interests, and the result was that last summer Bergmann & Co., the Edison Lamp Company and the Edison Machine Works, while each preserving their own identity, united informing The United Edison Manufacturing Company, which concern has now taken over from the Isolated Company all that pertains to Isolated business, agreeing to pay the Isolated Company certain fixed royalties and also one-half in any profit that may be shown. Thus our manufacturers are brought in direct contact with our competitors, the expensive clerical machinery of the Isolated Company is abolished, and profits in the way of royalties are secured for the Isolated Company. The wisdom of this change must be so apparent that your Trustees deem it unnecessary to dwell on the subject at any great length.

The Isolated Company still acts as our Exploiting Agent for Central Station business under the contract made in 1884. While that arrangement was necessary at the time, owing to the low financial condition of your Company, and has resulted greatly to your benefit, it is now believed that the success of your Company and also of the Isolated Company, could be promoted by the consolidation of the two enterprises.

The paid-in Capital of the Isolated Company is $370,200 issued for cash and $382,500 issued to this Company for patent rights. There is an additional amount of capital which has not yet been called for by the Isolated Company and which it now seems unnecessary to call.

It is proposed in substance, therefore, that the Capital of the Isolated Company be fixed at its present amount, say $752,700, against which it has on hand, cash and available assets for about $370,000, and the patent rights acquired from us for $382,500, as stated above, which patent rights carry with them valuable royalties developed in the Isolated business. The Isolated Company can turn over to this Company all its assets, patent rights and royalties of every kind and in exchange it is proposed we shall cancel our own stock holdings in the Isolated Company and issue to it such an amount of our stock as will give each stockholder of the Isolated Company in the proportion of $300 of Light Company stock for every $400 of Isolated stock now outsanding. Your Board are entirely in favor of this plan, and recommend that all necessary steps be taken to carry it out. They believe it to be equitable in itself and calculated to promote the best interests of all concerned.

The contract previously existing between this Company and the Western Edison Light Company, which exploits both our Isolated and our Central Station business in the States of Wisconsin, Illinois and Iowa, has been considerably modified. The Western Company had been put to great disadvantage, especially with its competitors in Isolated business, by reason of certain onerous restrictions in the original contract, which were of little or no practical value to us, while they acted as an effective barrier to any considerable business by the Western Company. At the time of its organization the Western Company paid us $50,000 in cash for its license rights, and under the new arrangement there is held in trust for our benefit $100,000 of its stock (out of $500,000 capital) which the Western

Company is gradually to retire by delivering to us in its stead stock of Central Stations to be organized by it under conditions satisfactory to us.

The Electric Railway Company of the United States has continued its experiments with some degree of success, though not so satisfactorily as was hoped for a year ago. The defects in its system seem, however, to be met by certain inventions controlled by the Sprague Electric Railway and Motor Company, with which this Company and the Elec-Electric Railway of the United States are on most friendly relations, and a consolidation of the two systems is now under consideration. The inventions of the Sprague Company are so novel in their character that it is believed they would be peculiarly free from interference with or trouble from other inventors; and, taken in connection with the established claims of the Electric Railway Company of the United States. would practically control the field of operations.

During the past year the counsel of the company have been actively conducting the litigation on our patents. In some of the suits brought against the various infringing companies, testimony on behalf of this company has been already taken, and in others is in process of taking. In those suits where it is claimed the American patents have expired by reason of the limitation of foreign patents, the question of law involved will probably be argued this fall. Testimony has also been taken in the suits brought against this company by the Consolidated and United States Companies, and all the suits brought both by and against this company are being pressed by the counsel of the company as rapidly as possible, and it is expected that within the next year some definite results will be reached.

Within the past few months our central station patents have for the first time been infringed. Suits are about to be brought on these patents and will be pressed with the utmost vigor. The great amount of work required in these litigations has made it necessary to emply additional advisory counsel, and,

at the suggestion of the counsel of the company, in addition to Mr. Evarts, Mr. Clarence A. Seward has been retained.

Active work has been done in the soliciting of new patents, and several important patents have been obtained.

In the past, your Board has received frequent requests to furnish statements showing the profit or loss on your business. These requests, while most natural in themselves, have been quite impossible to comply with, owing to the question of valuation of patents. In determining the result of business, at what sum should these patents, which have cost about $750,000, be carried forward? Until within the last two years their value had not been demonstrated; we now have, however, reached a stage which offers some basis for calculation. In the past twelve months your patents have earned for you $244,350, at which rate they would pay for themselves in three years, and under such circumstances, your Board would certainly be justified in carrying them forward at their cost as they are evidently worth that sum many times over. Acting, however, on the theory that the cost of patents, however valuable they may be, should be gradually written off, as the life of the patents themselves grows shorter year by year, your Trustees, in making up the statement of profit and loss attached to this report, have deemed it prudent to charge off 25% of the cost of all patents, and recommend that hereafter an annual reduction, of say 15% of their cost be continued, so that in a few years the account of patents shall disappear from our books altogether.

In the computation of Profit and Loss, the stocks of our various Illuminating Companies held by us have been taken at their par value, though on the average they are worth more. It may not be amiss to state here that the practice of issuing watered stocks has not been permitted by us in the case of any of the Edison Illuminating Companies, *and they all represent, dollar for dollar, cash paid in* and the regular payment to us for our license rights.

It will be noticed that in the statement of Profit and Loss, the stocks of the Isolated Company and of the Electric Railway Company have not been taken into consideration, though if they had been taken at their face they would increase the result by $715,900; but as the value of the railway stock has not yet been shown, and as the Isolated Company will probably be shortly consolidated with us, your Trustees have preferred to err on the conservative side, and leave these items in abeyance for the present.

Your attention is invited to the Balance Sheet herewith.

By order of the Board of Trustees,

E. H. JOHNSON,
Vice-President.

16 AND 18 BROAD STREET.
New York, October 26, 1886.

THE EDISON ELECTRIC LIGHT COMPANY,

Dr.

Stocks and Bonds:

Stock Edison Co. for Isolated Lighting	$255,999 25	
do. do. do. 50% paid	127,500 00	
do. Electric Railway Co. of the U. S.	333,400 00	
do. Electric Illuminating Co. of N. Y.	100,000 00	
do. of other Edison Electric Illuminating Companies..	245,795 00	
do. of our own Company in Treasury, full paid	89,500 00	
do. of Gramme Co. (par $5,000)	1 00	
Bonds of Ashland Co	800 00	
do. Johnstown Co......	3,000 00	
		$1,140,914 25

Patents:

T. A. Edison	$400,400 00	
Sundry Patents	6,600 00	
Menlo Park Expenses	169,587 51	
Patent Fees and Expenses	79,106 56	
Various Experimental Expenses	82,915 55	
Legal Expenses	30,297 72	
Canadian Expenses	26,766 79	
South American Expenses.	36,879 48	
Sundry Expenses	9,874 55	
	$791,868 10	
Less Sinking Fund, 25% (see page 16 of Report)....	198,001 58	
		593,866 61

Special Trust Fund (See pages 3 and 4 of Report)..........		51,612 30
Invested in $43,000 N. Y. Central & Hudson R. R. 5% bonds, worth..........	$46,440 00	
Loan on Demand......................	6,000 00	
Cash in Trustees' hands..	1,581 02	
Present value.......	$54,021 02	
Western Edison Co. Stock... (See page 14 of Report.)		100,000 00

Open Accounts:

Electric Railway of U. S..	$22,270 58	
Bills Receivable...	5,559 90	
Sundry Accounts...	8,932 78	
		36,763 26
Cash........................		2,269 04
		$1,934,420 15

BALANCE SHEET, SEPTEMBER 30, 1886.

Cr.

Capital Stock..	$1,080,000 00	
Less due on Subscriptions...	1,000 90	
		$1,078,999 10

Open Accounts:

T. A. Edison, Contingent Account (see page 12 of last report)................	$65,105 70	
Sundry Accounts................	11,191 60	
Accounts and Bills Payable...	35,702 85	
		112,000 15
Profit and Loss..		28,420 90
Stock Licenses, Special Account, Not yet carried to Profit and Loss (see page 17 of Report)............		715,000 00
		$1,934,420 15

E. & O. E.
New York, Sept. 30, 1886.

F. S. HASTINGS,
Treasurer.

STATEMENT OF PROFIT AND LOSS ACCOUNT.

SEPTEMBER 30, 1886.

CR.

Stock and Bond licenses	$1,250,600	
Less not yet carried to Profit and Loss	715,900	
		$540,700 00
Cash licenses		152,870 77
Dividends and miscellaneous profits		59,874 35
		$753,445 13

DR.

Administrative, exhibition, canvassing, legal and miscellaneous expenses, Nov. 1, 1878, to date	$373,505 26	
Sundry worthless accounts, charged off	28,119 88	
Commissions to agents on Illuminating Companies organized	120,692 50	
Charged off on Gramme Co. stock	4,999 00	
Sinking fund against cost of patents	198,001 58	
		725,318 23
Balance at credit of profit and loss		$28,126 90

E. & O. E.
New York, September 30th, 1886.

F. S. HASTINGS,
Treasurer.

NOTE.—To this amount of	$28,265 01
There is to be added the amount due, but not yet received, from various Illuminating Companies for licenses, as stated on page 4 of report, viz, Cash	21,900 00
And Stocks	141,525 00
Making total at the credit of Profit and Loss	$191,690 01

C. S. 825.

THE EDISON

CENTRAL STATION

SYSTEM.

THE EDISON SYSTEM OF INCANDESCENT LIGHTING

AS OPERATED FROM

CENTRAL STATIONS,

UNDER THE PATENTS OF

THOMAS ALVA EDISON AND OTHERS,

OWNED BY THE

EDISON ELECTRIC LIGHT CO.

REPRESENTED BY THE

EDISON COMPANY FOR ISOLATED LIGHTING,

65 FIFTH AVENUE,

NEW YORK.

SECOND EDITION.

NEW YORK:
C. G. BURGOYNE'S "Quick" Print, 146-150 Centre Street.
1885.

THE EDISON ELECTRIC LIGHT CO.

OFFICERS.

EUGENE CROWELL, PRESIDENT.

EDWARD H. JOHNSON, VICE-PRESIDENT.

F. S. HASTINGS, SECRETARY AND TREASURER.

DIRECTORS.

DR. E. CROWELL,
E. H. JOHNSON,
T. A. EDISON,
J. HOOD WRIGHT,
C. H. COSTER,
ERASTUS WIMAN,
E. D. ADAMS,
SPENCER TRASK,
A. FOSTER HIGGINS,
R. L. CUTTING, JR.
F. R. UPTON,
CHAS. BATCHELOR,
F. S. HASTINGS.

THE EDISON CO. FOR ISOLATED LIGHTING.

Licensed by the Edison Electric Light Co. for the sale of Isolated Plants, and the formation of Central Station Companies.

OFFICERS.

EDWARD H. JOHNSON, PRESIDENT AND GENERAL MANAGER.

F. S. HASTINGS, SECRETARY AND TREASURER.

J. HUTCHINSON, MANAGER.

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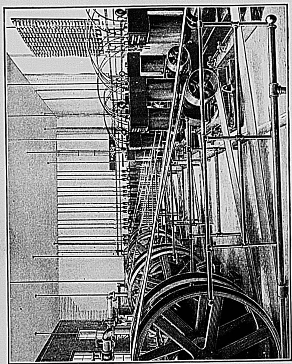


EDISON CENTRAL STATION, AT HARRISBURG, PA.
CAPACITY (EXCLUSIVE OF RESERVE), 4800 LAMPS.

THE EDISON SYSTEM

—OF—

LIGHTING FROM CENTRAL STATIONS.

New York, July 1st, 1885.

In order to answer the many enquiries constantly coming in from all parts of the country, we take pleasure in submitting a condensed statement of our business, its success electrically, mechanically and commercially, together with a brief outline of its history, and especially to state generally the methods adopted for the formation of sub-companies for the purpose of lighting cities and towns from central stations. For the information of any who may be unfamiliar with the subject, let us first consider the light itself.

Arc and Incandescent Lamps Compared.

These two systems of lighting are radically different and distinct, a fact which must be borne in mind when considering the question of what is popularly called "Electric Lighting." The arc is a light of great intensity—each lamp being the result of about one-horse power of steam energy condensed in one small point—is very dazzling and trying to the eye, and, from the very nature of its mechanism, is unsteady, flickering and changeable. Its

bad economy is due partly to the great amount of energy condensed in so small a point, the *diffusive* power of the light not being in proportion to its great intensity, or, technically speaking, the volume of light decreasing inversely as the square of the distance.

The incandescent is a small, soft, steady light, of the brightness of an ordinary gas jet, and is therefore especially adapted for domestic and industrial purposes.

The Edison Incandescent Lamp.

The lamp itself consists of a pear-shaped glass globe about four and a half inches in height, exhausted of air, into which is sealed a filament of carbonized bamboo slightly thicker than a horse-hair. This filament, becoming incandescent by the passage of the current of electricity through it, emits a beautiful, soft, white light, absolutely steady and constant, and equaling in intensity, or exceeding if desired, the illuminating power of a gas jet of the best quality.

The lamp is screwed into a socket which is permanently attached to a gas or other chandelier or bracket, and contains a key whereby the light in the lamp may be turned on or off. The lamp, once screwed into the socket, needs no further attention or care until the carbon breaks, when the old lamp is unscrewed from the socket and a new one screwed in, the work of a few seconds, and of an ordinary domestic. The lamps vary in the number of hours which they will burn, but their average life, at 16 candle power, exceeds 600 hours of actual burning. Each light is entirely independent of the others, and may be arranged and controlled singly, in pairs, or in groups of any desired number, and may be placed in any position whatever, inverted or otherwise.

The Edison lamp gives out but little heat (less than one-fifteenth as much as gas), may be grasped by the naked hand without inconvenience, is absolutely free from odor and poisonous or noxious gases, and neither heats nor vitiates the surrounding atmosphere.

The lamp does not explode, and even if the glass is broken by any accident, the carbon is instantly consumed and the light at once goes out harmlessly.

Besides being unequalled for domestic and general illumination, the light is especially adapted to the workshop. For the desk and workbench it is superior to any other artificial light, inasmuch as it is absolutely steady, and by inverting the lamp, its whole light may be thrown on the work in hand, in any required position whatever.

The light, although bright and clear, is not injurious to the eyes, even if used close to them. Indeed it is found in practice that weak eyes, previously injured by gas, may use the light with impunity.

The fixtures used for this lamp are of the same general character as those used for gas, including swing brackets, drop lights, portable lights, together with devices for inverting the light or burning it in any position, perpendicular or otherwise, and also for burning it in firedamp and under water.

Safety.

There is no danger to life, health, or person, in the current generated by any of the Edison dynamos. The intensity of the electric current is so feeble that the wires at any part of the system, and even the poles of the generator itself, may be grasped by the naked hand without the slightest effect; in fact, the current is scarcely perceptible to the touch.

Besides the safety from injury to the person, another prominent feature of the Edison system is its freedom from danger of fire. This is secured by means of a small automatic device invented by Mr. Edison, called the "Cut-out" (or "Safety-catch"), which may be compared to an overflow pipe in a water system, or to a safety valve on a steam boiler. The safety-catch consists of a small piece of wire, fusible at a low temperature, which is placed in every circuit. If, therefore, the wires should become heated from any cause, this safety-catch would at once melt off and open the circuit, thus averting all possible danger from fire. The circuit can be again closed by taking out the safety plug and putting in a new one, the work of a moment. Fires from electric light arise from one of three causes: first, a crossing of wires, that is to say, wires coming in contact with each other; second, the jumping of the current from one wire to the other; third, the overloading of wires with a greater amount of current than they are calculated to bear, and thereby melting them. Under the Edison system fires are impossible from any of these three sources. Not only are the wires thoroughly insulated, and, also, when necessary, protected by mouldings, but the "cut-out" is so introduced in the wires that fire from any cause whatever is absolutely impossible. The lamp is now in use in a large number of factories, public institutions, stores, steamboats, steamships and dwellings, yet no fire has ever taken place in the Edison system.

Introduction of the System.

The Edison Electric Light Company was organized for the purpose of acquiring and owning all of Edison's patents for electric light, heat and power, in North

and South America, and from this, the Parent Company, all the sub-companies working under the Edison system derive their existence. Of these patents, 260 have been already issued in the United States, including the patents securing to the Edison Company *the fundamental principles of incandescent lighting*, and there are applications for 187 additional patents still pending in the Patent Office, which number is being constantly increased by Mr. Edison's further inventions. These inventions form the *complete system* of Edison's incandescent lighting, now so completely introduced into public use.

There are two methods of introducing the light, viz., by independent or Isolated Plants, where the apparatus is owned, controlled and operated by the user of the light, and by the Central Station System, where the current is generated at a common source, and distributed, after the general plan adopted by gas companies. The first method is conducted by the Edison Company for Isolated Lighting, which was organized in November, 1881, and which, as a licensee of the Edison Electric Light Company, is entitled to do business under the Edison patents for electric lighting. Since its organization, and up to this date, there have been installed in mills, factories, hotels, steamships, stores, residences, etc., in the United States alone, upwards of 500 isolated plants, aggregating about 126,000 lamps, in addition to about 70,000 lamps operated from central stations.

The installation and use of these isolated plants, mostly by private enterprise, have involved individual investments varying from $500 to $50,000. No other evidence could more forcibly demonstrate (1) that the light, as a light, *must* be giving satisfaction; (2) that being used on so large a scale, its *economy* is firmly established; and (3) owing to the large sums of money invested in plants by individuals and corporations, the

value of the system as an investment has been determined beyond possibility of doubt.

It has frequently been found that the cost of the light in mills, etc. (where attendance and power are present, but including a proportion of their cost), has been equal to gas at forty cents to one dollar per thousand feet, varying with the cost of fuel and the number of hours yearly use.

Estimates for lighting of this class may be had on application to this office.

Central Station Lighting.

The inauguration of this business on a large scale was commenced by the granting of a license to the Edison Electric Illuminating Company of New York. This company selected its first district in the lower part of the city, and immediately proceeded to install a central station plant with a capacity of 8,000 lamps.

About twenty-eight miles of conductors were laid under the streets, and the current was first delivered to a small number of customers, September 4th, 1882. The first bills for light were rendered to customers in January, 1883. The price charged for the light in this district is at the rate of 1¼ cents per hour for each sixteen candle power lamp, which is equal to gas at $2.25 per thousand feet.

The Edison meters furnish the data, in every case, from which the bills for these customers are made out. Each has a meter in his own premises, and his bill is made out and payment required upon what the meter shows. This inflexible rule has resulted in fixing close attention upon the meter, and has caused its accuracy and reliability to be subjected to severe tests. To measure accurately the electric current by means of a

meter, and to do so with sufficient exactness to make out a bill, the payment of which was to be insisted upon, at first seemed to many of our customers an impossibility; and they accordingly resorted to various devices for the purpose of themselves testing the accuracy of the measurement. The most noteworthy of these, and one especially worthy of mention, for the reason that it affords a simple and effective check against an incorrect bill, was to keep a record of the hours each lamp was in use, and, by multiplying this number of lamp hours by the given cost of a lamp per hour, to determine what the amount of the bill ought to be.

There have been many cases where, in order to satisfy customers that the meters were reliable, we have taken them out at the end of a given time, during which the customer has kept an account of his lamp hours, and have presented bills made out on what the meters showed, in order that the customer might check the amount of the bill by the simple rule mentioned above. In all of these cases the accuracy of the meter has been maintained, and the confidence of the public has steadily increased, so that, at the present time, it can be safely said that the Edison meter, originally considered by some to be, possibly, the only doubtful part of the Edison system of central station lighting, is now generally admitted to be both scientifically and practically exact and reliable.

Perhaps the most important element in the success of an enterprise of this nature is the commercial aspect, as shown by a balance sheet. In this connection, it should be borne in mind that our first district is one of the poorest in this, or, indeed, in any other large city, by reason of the limited amount of night lighting. The district embraces no residences, hotels, saloons, theatres, or places of amusement of any kind, nearly all the

lighting being done during the day, and a large portion of it only from dark until about six o'clock P. M., during the winter months.

During the past eighteen months we have increased the capacity of the station about forty per cent., which increase has been paid for out of our earnings, the entire capacity has been taken up by new customers, the company is entirely free from debt, with a cash surplus on hand, and applications for more light than the station can supply. The earnings will hereafter be applied to the payment of dividends, which are now being declared and paid regularly, thus demonstrating the *commercial* success of the Edison system of lighting from central stations, even in a first experiment with all its attendant mistakes and extraordinary costs.

As already stated, the price charged for the light is an equivalent of gas at $2.25 per thousand. Some months ago the price of gas was reduced to $1.50 per thousand, for large consumers. One of our largest customers, proprietors of a well-known establishment, operated on principles of the strictest economy, notified us that, although they much preferred our light, unless we would make a corresponding reduction in our price, they would be obliged reluctantly to return to the use of gas as a measure of economy. We declined their proposal, on the ground that we had upwards of one hundred applications for the light in excess of the capacity of the station. Several months have elapsed, and they continue to use our light and pay our bills, regularly, at the old established price.

That the reduction in the price of gas did not affect the sale of our light will be shown by the following statement: we lost *nine* consumers—300 lamps—from whom we received $250 per month. This loss gave us an opportunity to supply current to *seven* others that had been impatiently waiting till we could

supply them. Among these, Harper Bros., Bank of New York, New York "Sun," etc., aggregating about 320 lamps, for which we receive about $450 per month.

The system of Central Station Lighting being *proved commercially*, we have been effecting the formation of central station lighting companies, with local capital, in various parts of the world, a partial list of which is given below:

Name of City or Town.	State.	No. of Lamps.
Berlin	Germany	14,000
Milan	Italy	8,000
New York	New York	8,000
Bellefonte	Pennsylvania	800
Middletown	Ohio	500
Williamsport	Pennsylvania	3,200
Piqua	Ohio	1,000
Newburgh	New York	2,400
Tiffin	Ohio	1,000
Fall River	Massachusetts	2,400
Hazleton	Pennsylvania	1,000
Lawrence	Massachusetts	3,200
Shamokin	Pennsylvania	2,400
Brockton	Massachusetts	2,400
Circleville	Ohio	1,050
Cumberland	Maryland	1,000
Des Moines	Iowa	1,600
Appleton	Wisconsin	500
Harrisburg	Pennsylvania	4,800
Westchester	Pennsylvania	1,600
Johnstown	Pennsylvania	1,000
Tamaqua	Pennsylvania	1,600
McKeesport	Pennsylvania	1,600
New Brunswick	New Jersey	1,600
Boone	Iowa	600

Will it Pay?

Those of the above-mentioned companies that have been in operation a reasonable length of time show that they are earning a handsome dividend on their capital stock, varying from six to twenty per centum per annum, although none of them have as yet connected the full capacity of their respective stations.

Several dividends have already been paid, and these and others will be continued regularly, in proportion as the business of the several stations increases. Take as an example one of our more recent stations. The company referred to started with a capacity of 3,200 lamps, with a reserve to provide for accident. Following our advice, and in many particulars even exceeding our recommendations, the station was installed in the most thorough possible manner, with ample reserve both in mechanical and electrical appliances, so that neither would ever be called upon to its utmost capacity, thereby securing the maximum of economy and minimum of depreciation. As a result of the confidence thus inspired, consumers did not hesitate to abandon gas, knowing that the supply of electric current would be quite as much to be relied upon, and the station was started May 1st, last, with 3,000 lamps connected, all of which were under contract for one year or more. These contracts secured to the local company a net profit, above all expenses and depreciation, of $1,700 per month. The company is now earning at the rate of

TWENTY-ONE PER CENT. PER ANNUM,

and will soon begin to pay regular ten per cent. semi-annual dividends.

This gratifying result has led the company to increase its capital stock, and orders for additional apparatus have just been given which will increase the present capacity of the station from 3,200 to 4,800 lamps. Aside from the character of the investment, this enlargement of the plant has been made necessary by reason of the rapidly increasing demand for the light.

PLAN OF ORGANIZATION.

Our present policy is not to part with large portions of territory, or to sell territorial rights, as is being attempted by companies not yet past their experimental stage, but to grant to separate companies, formed with local capital, exclusive licenses for the use of the Edison patents, within specific cities and towns.

In selling a central station plant to a sub-company so formed, instead of charging a cash profit for the plant and equipment, we charge only the actual cost of the plant, and in lieu of all profit we take a percentage of the capital stock of the sub-company, payable generally five per cent. in cash, and the balance in the stock itself, which insures to the sub-company our interest in the successful operation of the plant.

By this plan the Edison Electric Light Company becomes a large stockholding company, and its prime object, as a partner in the various sub-companies, is to make their stocks dividend-paying, since its own income must be derived from the dividends accruing on the stocks which it holds.

This will be recognized as a measure obviously in favor of the sub-licensee, and we have been led to its adoption by our faith in, and knowledge of, the possibilities of the system *commercially*, as well as mechanically and electrically.

Were we to sell the plant outright, charging an advance over cost, and taking the profit in cash, the revenues thus accumulated would bring us in only the current rates of interest, whereas we have now had sufficient experience to assure us of a much greater income by taking these profits in stock, and so retaining an interest in each central station plant.

In consideration of this stock profit issued to us by the sub-company, we grant an exclusive license for the

use of all of Mr. Edison's inventions relating to electric light, heat and power within the corporate limits of the city or town to be lighted.

Cost of Central Station Plants.

A central station plant and equipment consists of a lot, building, boiler, engines, dynamos, apparatus for regulating the current in proportion to the number of lamps in use, meters, street conductors, and a full complement of the tools, instruments and apparatus required for the proper operation of the system. It is impossible to estimate accurately the cost of such an equipment complete, without making a survey and canvass of the city or town to be lighted, although for a given number of lamps, the cost of the station equipment itself may be ascertained by application to this office, or to an agent of the company. The unknown quantity is the cost of the street conductors, which varies in every locality, and depends upon the distribution of the lamps, their distance from the central station, whether compact or scattered, &c. From a general description of a town, its population, area, &c., a comparison may be made with other towns already lighted, and, by such a comparison, a general idea may be formed of the approximate cost of a plant, which will serve as a guide in the formation of a company. Before executing a contract, however, an accurate canvass and determination are made, and the sub-company is furnished with a detailed statement of the cost of the plant, at which price it will be installed and operated for a sufficient length of time to instruct the local employees in its use, when it is turned over to the sub-company in complete running order.

It must be borne in mind, however, that this company

makes no profit whatever in the installation of these plants, and, being a stockholder in the local company, our interest is in having the plant installed at as low a cost as is consistent with thoroughly proper construction. It is, therefore, at the option of the local company to purchase the boilers, engines, dynamos and apparatus themselves, installing their own plant, on plans and specifications furnished by us, with the aid of our experience and under the personal supervision of our own trained experts. On the other hand, the rapid growth of the business has led to the organization of responsible constructing firms, who are thoroughly competent to erect and equip these stations, and who will at any time furnish estimates and proposals for the work.

Construction of Stations.

These stations are now constructed in accordance with a standard adopted by the new management after a personal and most thorough examination of the past experience and present condition of existing stations. This examination has forced the present management to the inevitable conclusion that in the construction and operation of central stations, there are two elements, which, while they have always been regarded as *important*, must now be *insisted* upon as *absolutely essential* to the successful development of the business.

We refer to *economy* and *reliability;* but while economy is to be carefully studied and sought after, both in construction and operation, economy in *operation* is the desideratum, and we will demonstrate conclusively, not only that this feature of success does not always follow what would ordinarily be regarded as economy in construction, but that it can only be secured by a judicious liberality of expenditure in the first cost of the

plant. Important as this may be, however, it sinks into insignificance when compared with the one vital question of *reliability*. This is the one requisite, *sine qua non*, paramount to all other considerations, and the one *principle* which we, as stockholders with the local people, must now insist upon as essential to the establishment of a fixed commercial and *intrinsic* value to the stocks accumulating in our treasury. How to secure most effectually this end has been the study and aim of the present management.

Our first central stations were put in on the theory that as the engines would be selected of such a size as to obviate the necessity of their ever being worked up to their normal capacity, no reserve would be required. Although this theory was in a measure correct, it was found in practice, that many gas consumers, whose business necessarily depended to a certain extent upon some form of artificial light, were unwilling to cut off their supply of gas, so long as their supply of electric light would depend upon the reliability of *one* engine. The explanation that there was a reserve capacity in that engine itself was not sufficient to satisfy them in assuming what they regarded as a risk. In order to overcome this prejudice some of our local people were therefore compelled to put in spare engines and dynamos in order to induce some large consumers to cut off their gas, and by this means they succeeded in securing some of the most desirable customers within reach of the station. Hence, we now insist on carrying out this general principle of providing a reserve wherever possible, in every detail of construction, with two inevitable results: *first*, the public is inspired with confidence from the fact that they can depend absolutely upon a constant supply of light, so far as any human foresight can assure it, even with greater certainty than can be expected from an ordinary gas works; and, *second*, by

reason of the confidence thus inspired, the station is started with a sufficient number of customers to insure a profit from the beginning, and to earn a dividend the first year of operation.

Cost of the Light.

The cost of producing the light and distributing it from central stations varies greatly, according to the size of the plant, the average hours of daily use, &c. For example, a plant with a given capacity and the requisite employees, will require a certain number of lamps connected and running, in order to pay the actual expenses of operating. Increase the number of lamps, the receipts will be increased proportionately, while the expenses of operating will remain almost constant, excepting the cost of the additional coal and lamps, which is a small proportion of the aggregate operating expenses. As a practical illustration, the experience in some of our central stations already in operation may be of interest.

In one city, the price charged consumers was fixed at an equivalent of gas at $2.25 per thousand, and the station commenced operations with only a small proportion of its lamp capacity in use. After running a short time, it was found that the actual cash receipts were only sufficient to meet the running expenses. Under these conditions, the cost of the light to the company was equal to what it received, viz., an equivalent of $2.25 per thousand feet for gas; but at that time there were connected and in use only a very small proportion of the number of lamps for which the station was calculated. New customers were daily added, until the cash receipts were nearly double the expenses, and by the same calculation it was found that the light cost the

company an equivalent of $1.15 per thousand for gas, or only a little more than one-half of what they were receiving. As the number of lamps increased, the increase of running expenses was barely appreciable, while the receipts were increased proportionately with the number of lamps connected.

In another gas town, a central station was started a short time ago, with a capacity of sixteen hundred lamps. At the present time they have only four hundred lamps connected, and the income from these is sufficient to pay the running expenses of the plant, showing that when all the lamps are connected, a very handsome profit will be earned, which, it has been estimated, will be sufficient to pay annually a dividend of more than twenty-five per cent. on the capital stock of the company.

In a still smaller town, a plant of only five hundred lamps, which has been in operation only a short time, is already earning a profit which will be equal to an annual dividend of twenty per cent. on the capital stock of the company.

While these statements of facts in connection with the cost of the light are interesting by way of comparison, experience dictates that the price of gas in a city or town has absolutely no bearing whatever on the price of the incandescent light. Such has always been the theory of Mr. Edison, and it has been fully and notably borne out by experience. The policy of our sub-companies has been to fix a fair price for the light, usually about the same as has been charged for gas, and to stand by that price without regard to any action the gas companies might take. In one town, where gas was selling at $4.00 per thousand, our sub-company, considering this price too high, and being confident of a handsome profit on a lower basis, commenced charging an equivalent of $2.50 per thousand. The gas company, becom-

ing alarmed, immediately lowered their price to $1.10 per thousand. The result has borne out our theory in every particular, and not only have they under such circumstances failed to influence any customers from us, but in many instances, people who had been using kerosene gladly took our light at the price established, although the gas company offered them every inducement to use gas, in some instances going so far as to offer to furnish a full equipment of gas pipe, fixtures, &c., free of expense to the consumer.

The following table, showing the cost of operation, is not a mere estimate, but is based upon the experience of stations actually established. Such items as coal, water, taxes, insurance, &c., will, of course, vary in different localities, but are given as a fair average, with the exception of coal, which is calculated at four dollars per ton. The daily consumption of light is calculated 2½, 3, 3½ and 4 hours consumption:

ESTIMATED MONTHLY RUNNING EXPENSES,

BASED UPON STATIONS ALREADY IN OPERATION.

2½ HOURS AVERAGE.

Capacities.	800 Lamps.	1200 Lamps.	1600 Lamps.	2100 Lamps.	3200 Lamps.
Labor	$100 00	$145 00	$175 00	$200 00	$250 00
Coal*	41 50	69 00	93 00	139 68	186 00
Lamps	60 00	90 00	120 00	180 00	240 00
Water	5 10	7 56	10 20	15 60	21 00
Oil and Waste	7 50	7 50	7 50	12 00	15 00
Repairs	12 00	19 50	24 00	36 00	48 00
Insurance	8 00	12 00	15 00	20 00	25 00
Taxes	8 00	12 00	15 00	20 00	25 00
Sundry Extras	30 00	30 00	30 00	30 00	30 00
Stationery	4 50	4 50	4 50	4 50	4 50
	$276 60	$397 06	$494 20	$657 78	$844 50

3 Hours Average.

Capacities.	800 Lamps.	1200 Lamps.	1600 Lamps.	2400 Lamps.	3200 Lamps.
Labor	$100 00	$145 00	$175 00	$200 00	$250 00
Coal*	56 00	84 00	112 00	167 62	223 00
Lamps	72 00	108 00	144 00	216 00	288 00
Water	6 00	9 00	12 00	18 00	24 00
Oil and Waste.	7 50	7 50	7 50	12 00	15 00
Repairs	12 00	18 00	24 00	36 00	48 00
Insurance	8 00	12 00	15 00	20 00	25 00
Taxes	8 00	12 00	15 00	20 00	25 00
Sundry Extras.	30 00	30 00	30 00	30 00	30 00
Stationery	4 50	4 50	4 50	4 50	4 50
	$304 00	$430 00	$539 00	$724 12	$932 50

3½ Hours Average.

Capacities.	800 Lamps.	1200 Lamps.	1600 Lamps.	2400 Lamps.	3200 Lamps.
Labor	$100 00	$145 00	$175 00	$200 00	$250 00
Coal*	65 00	98 16	130 00	195 56	260 00
Lamps	84 00	126 00	168 00	252 00	336 00
Water	7 05	10 44	14 10	21 15	29 00
Oil and Waste.	7 50	7 50	7 50	12 00	15 00
Repairs	12 00	19 80	24 00	36 00	48 00
Insurance.	8 00	12 00	15 00	20 00	25 00
Taxes	8 00	12 00	15 00	20 00	25 00
Sundry Extras.	30 00	30 00	30 00	30 00	30 00
Stationery	4 50	4 50	4 50	4 50	4 50
	$326 05	$465 40	$583 10	$791 21	$1,022 50

4 Hours Average.

Capacities.	800 Lamps.	1200 Lamps.	1600 Lamps.	2400 Lamps.	3200 Lamps.
Labor	$100 00	$145 00	$175 00	$200 00	$250 00
Coal*	74 40	111 60	149 00	223 50	298 00
Lamps	96 00	144 00	192 00	288 00	384 00
Water	8 16	12 24	16 20	24 30	32 40
Oil and Waste.	7 50	7 50	7 50	12 00	15 00
Repairs	14 00	21 00	24 00	36 00	48 00
Insurance	10 00	12 00	15 00	20 00	25 00
Taxes	8 00	12 00	15 00	20 00	25 00
Sundry Extras.	30 00	30 00	30 00	30 00	30 00
Stationery	4 50	4 50	4 50	4 50	4 50
	$352 56	$499 84	$628 20	$858 30	$1,111 90

*Note.—Coal is calculated at $4 per ton.

Profits and Dividends.

Given a complete station, and the cost of operating it under varying conditions, it remains for the local company, as in any other enterprise, to adopt such management and business methods as will insure an economical administration of its affairs, and a fair price for its product.

In the tables on the following pages the expenses have been taken from the table on the preceding pages, and the receipts have been based upon an equivalent of gas at $1.50, $2.00 and $2.50 per thousand feet, with a daily average consumption of from 2½ to 4 hours.

STATEMENT OF ESTIMATED PROFITS.

800 Lamps, Capital $32,000.

@ $1.50 per 2,000 Candles.*					@ $2.00 per 2,000 Candles.*					@ $2.50 per 2,000 Candles.*				
Hours Running.	Yearly Receipts.	Yearly Expenses.	Net Profit.	Percentage for Dividend.	Hours Running.	Yearly Receipts.	Yearly Expenses.	Net Profit.	Percentage for Dividend.	Hours Running.	Yearly Receipts.	Yearly Expenses.	Net Profit.	Percentage for Dividend.
2½	$4,500	$2,960	$1,540	4½%	2½	$6,000	$2,960	$3,040	9½%	2½	$7,500	$2,960	$4,540	14%
3	5,400	3,240	2,160	6¾%	3	7,200	3,240	3,960	12%	3	9,000	3,240	5,760	18%
3½	6,300	3,460	2,840	8¾%	3½	8,400	3,460	4,940	15%	3½	10,500	3,460	7,040	22%
4	7,200	3,725	3,475	10¾%	4	9,600	3,725	5,875	18%	4	12,000	3,725	8,275	25½%

1,200 Lamps, Capital $40,000.

2½	$6,750	$4,260	$2,490	6%	2½	$9,000	$4,260	$4,740	11¼%	2½	$11,250	$4,260	$6,990	17%
3	8,100	4,590	3,510	8¾%	3	10,800	4,590	6,210	15½%	3	13,500	4,590	8,910	22%
3½	9,450	4,944	4,506	11%	3½	12,600	4,944	7,656	19%	3½	15,751	4,944	10,806	27%
4	10,800	5,290	5,510	13¾%	4	14,400	5,290	9,110	22½%	4	18,000	5,290	12,710	31½%

1,600 Lamps, Capital $50,000.

2½	$9,000	$5,292	$3,708	7%	2½	$12,000	$5,292	$6,708	13%	2½	$15,000	$5,292	$9,708	19%
3	10,800	5,740	5,060	10%	3	14,400	5,740	8,660	17%	3	18,000	5,740	12,250	24½%
3½	12,600	6,181	6,419	12¾%	3½	16,800	6,181	10,619	21%	3½	21,000	6,181	14,819	29½%
4	14,000	6,632	7,768	15%	4	19,200	6,632	12,568	25%	4	24,000	,632	17,368	34½%

2,400 Lamps, Capital $65,000.

2½	$13,500	$6,978	$6,522	10%	2½	$18,000	$6,978	$11,022	16¾%	2½	$22,500	$6,978	$15,522	23¾%
3	16,200	7,641	8,559	13%	3	21,600	7,641	13,959	21%	3	27,000	7,641	19,359	29¾%
3½	18,900	8,312	10,588	16%	3½	25,200	8,312	16,888	25¾%	3½	31,500	8,312	23,188	35¾%
4	21,600	8,983	12,617	19%	4	28,800	8,983	19,817	30%	4	36,000	8,983	27,017	41¾%

3,200 Lamps, Capital $80,000.

2½	$18,000	$8,945	$9,055	11%	2½	$24,000	$8,945	$15,055	18¾%	2½	$30,000	$8,945	$21,055	26%
3	21,600	9,825	11,775	14¾%	3	28,800	9,825	18,975	23¾%	3	36,000	9,825	26,175	32¾%
3½	25,200	10,725	14,475	18%	3½	33,600	10,725	22,875	28¾%	3½	42,000	10,725	31,275	39%
4	28,800	11,619	17,181	21%	4	38,400	11,619	26,781	33%	4	48,000	11,610	36,381	45%

* Equivalent of 1,000 feet ordinary gas.

Comparisons with Gas.

While comparisons with gas are interesting for purposes of calculation, practical experience affords daily evidence of the fact that the price of gas has no more influence on the price of our light, than the price of candles has on the price of kerosene. On the same principle, it is difficult to demonstrate *theoretically* why the advent of elevated railways, with their enormous patronage, has not done away with surface cars; and yet the fact remains that there is patronage for both, and both are financially successful.

The fundamental principle is this: people have continued the use of gas while the price of kerosene has been constantly declining, simply because of the superiority and greater convenience of gas, and for the same reason they will continue the use of the incandescent light, notwithstanding any reduction experimenters may accomplish in the cost of producing gas. The possible uses of gas produced at a low cost will cover a broad field, but, as an illuminating agent, its usefulness is limited; and, in the same manner as it took the place of kerosene, candles, and other crude forms of light, it is now gradually but surely being displaced by the incandescent system.

Any further information may be obtained by calling upon or addressing

THE EDISON ELECTRIC LIGHT COMPANY,
65 Fifth Avenue,
New York.

L. Stieringer

~~strictly~~ personal & confidential

Compliments of T. N. Vail

INTRODUCTION.

IN furnishing our agents with this second and revised edition of our Central Station Catalogue, we invite their particular attention to a few important items.

FIRST. We herewith supply them such data as will enable them at a distance, and without reference to this office, to determine approximately the cost of Central Stations, and the capitalization of Local Companies of various sizes, with all that degree of accuracy obtainable by our own expert engineers, previous to a final careful canvass and electrical determination.

SECOND. The figures presented concerning the operating expenses, receipts and profits of Local Companies, either real or prospective, are derived from carefully compiled statistics, and afford convincing proof that fair dividends can be earned upon capital invested in a properly managed Edison Company.

GROWTH OF THE EDISON CENTRAL STATION BUSINESS. (1885

It is but little more than five years since Mr. Edison conceived the idea of Central Station distribution, at which time many prominent scientists ridiculed him, and argued that house-to-house lighting, on a scale large enough to render the undertaking a commercial success, was but an impracticable dream.

Now, even "our friends, the enemy" (the Gas Companies) acknowledge that the problem of supplying the Edison Incandescent Light for the service of the individual consumer, by a system of house-to-house lighting is a practical success, and are content with expressions of doubt as to our ability to make a profit in competition with them.

Heretofore we have only been able to present hypothetical denials of such statements; *now we are able to offer the proof afforded by the commercial success of numerous stations* which have *been in operation* FOR A PERIOD OF FROM ONE TO THREE YEARS.

There are now organized in the United States forty-seven Edison Illuminating Companies, employing a capital of $5,000,000.

The stations and systems of forty of these companies are in active operation, and ten of them are in course of construction.

These fifty-seven stations will supply current to about 160,000 Edison lamps at the time of their completion, but as experience shows that every such station almost invariably increases its capacity immediately after opening for business, it is likely that this number of lamps will be doubled within a year.

The capital of the New York Illuminating Company has just been increased to $2,500,000.

With this increased capital it is proposed to start three large additional stations in New York City during the coming season, two of which will be ready for operation in time for next fall's lighting season, the requisite real estate having already been purchased.

During the past winter our agents have been engaged in the preliminary work of organizing upwards of forty additional Illuminating Companies, ninety per cent. of which will certainly be closed during the coming summer.

The commercial success of our Central Station System is attracting attention of capitalists and investors of foreign countries. Our Engineering Department is engaged on plans for Central Stations in Japan, China, South America and Sweden.

STREET LIGHTING.

During the past year much interest in the subject of street lighting has been developed by our local companies.

The Edison light has been brought into strong competition with the systems of gas and arc lighting, and has in the majority of cases carried the day.

Street lighting contracts are very profitable, because they furnish a source of revenue during hours when the station would otherwise be running its minimum load.

The cost of production is only felt in coal, water, oil, and lamp breakage, while other items remain the same as before, consequently the profits are proportionately larger.

Two systems of distribution are used.

FIRST, by special circuits and feeders in connection with the three-wire system.

This method can be used to advantage where the three-wire system covers the major area of the town, and lamps of any desired candle-power up to 250 candles can be obtained. The larger sizes of incandescent lamps will often be found as serviceable and more satisfactory than the arc system.

SECOND, by the Municipal System, wherein the lights are supplied from a special dynamo.

THE MUNICIPAL SYSTEM.

There are three points which will interest our agents:

1. WHAT THE MUNICIPAL HAS ALREADY DONE.

There have been seven installations made of this system, as follows:

	Number of Lamps.	Candle Power.	District Lighted.
Lockport, N. Y.	75	16 & 32	Outskirts of City.
Portland, Me.	300	10, 16 & 32	4 miles in length.
Lawrence, Mass.	550	10 & 16	Entire City.
Jacksonville, Fla.	150	10 & 16	1 mile from Station.
Brookline, Mass.	40	10 & 16	About 1 mile diameter.
Denver, Col.	530	20	Through the City.
Lachine Canal.	160	50	4 miles long.

It will be seen that this system has already been applied to a variety of conditions, and its details have been worked out so that

it is reliable and satisfactory. The prices secured in these cities are as low, or lower, than those of the gas which has been displaced and the greater elevation of the lamp gives a considerable advantage.

2. WHAT IT CAN DO.

The Municipal System has been specially devised for street lighting and enables the Edison light to be distributed over large areas, by the use of single lines of small wire.

It can also light groups of several small towns or suburban districts from one station.

It can be used with greatest facility in tunnels, mines and caves.

3. THE BEST METHOD OF EXPLOIT.

Demonstrate the serviceability of the system by small contracts in suburban districts or towns not reached by gas mains.

To secure satisfaction, the candle power of the electric lamp should always be superior to the gas or naphtha which it displaces. Electric light always means *more* light. Nothing less than 15-candle power lamps are suitable for narrow courts and alleys, and excepting in such cases we shall discourage the use of anything smaller than 20 candles.

Note especially the following points as to estimates. The widely varying conditions existing in different places in area to be covered by street lighting system; lamps required per square mile of this area; trees and other obstacles to pole lines; the proper size of conductors as affected by the price of coal, &c., all place it beyond our ability in the present early stage of this branch of the business to formulate any rules for reliable estimates on the cost of installation or expenses of operating. Agents should therefore send to this office in each case replies to the following questions, in response to which estimates will be forwarded showing the modification of our plan of running circuits, the type of lamp, and the patterns of pole and station apparatus which are best adapted to the particular instance:

1. What conditions are imposed by the city or the State law in granting a right of way? Please send copy of ordinance or vote under which you act.

2. What privileges can you secure (in writing) as to using poles of other people, and how far will it be desirable to do this?

3. Send a tracing or sketch, drawn to scale, showing location of lights to be displaced (designating gas, naphtha or other lights, by separate symbols); kind and locations of trees which will prove obstacles to pole work; location and approximate height of poles of other companies (using some sign for such as are suitable to support Municipal wires); kinds of sidewalk in the proposed district, and location of station.

4. Kind of coal available for boilers; cost delivered in station.

5. Location, extent and cost of any other feasible power (a water power at a considerable distance may sometimes be made economical).

6. Sizes and kind of poles most desirable, and cost delivered at the holes.

7. Present prices of gas or naphtha per post (annual); candle power of each; and hours burned per year. Specify also expense of repairs, lighting and extinguishing; also power of any other lights used and prices paid.

8. Probable future increase of the business.

ELECTRIC MOTIVE POWER.

The manufacture and sale of electric energy in the form of motive power is opening up, as it were, a new industry, and is offering to Central Station Companies a new and fruitful source of revenue.

Motive power being required during the day, and light at night, the product of the Electrical Plant is thus demanded throughout the entire 24 hours of the day.

The Sprague motor is endorsed by the Edison Company as embodying all those features of economy, perfect regulation, durability and simplicity so essential in a motor designed for general utility purposes.

The use of these motors to furnish power for small manufacturing establishments, printing offices, elevator work, sewing machines, ventilation, etc., has already become an established industry.

Electric power is more satisfactory than steam power; it is more easily handled, is clean, noiseless, free from heat and requires no skilled labor; may in fact be made perfectly automatic.

The charge for power should be governed by the cost of coal, water, labor and other items entering into the original cost of production of power in a central station.

The method of charge should be as in the case of steam, per H. P. of the motor's capacity.

The range of prices will be from $75 to $150 per year per horse-power.

The selling of motive power has the special advantage of furnishing a load, and consequently a revenue during the hours when the station would have its least load, were electric lighting its only function.

It is possible, under ordinary conditions, to sell thirty per cent. more horse-power than the station is furnishing, for the reason that out of a large number of consumers it will never occur that all motors connected will be required to give their maximum power at the same moment of time.

For these and other reasons explained more fully by the Motor Company, the sale of electrical energy for power purposes supplies a convenient and cheap power to the consumer and a handsome revenue to the producer. (See Sprague Electric Railway and Motor Co.'s printed matter.)

THE MAIN ARGUMENTS IN FAVOR OF THE EDISON LIGHT OVER ALL OTHER FORMS OF ARTIGIAL ILLUMINATION.

1st. The fact that it does not vitiate the atmosphere.

2d. That it does not destroy by deposit or otherwise decorative work, paintings, &c.

3d. That it is not affected by variable air drafts or other atmospheric conditions, and is consequently absolutely steady and reliable in all places and under all conditions.

4th. That any degree of brilliancy of a single unit may be had, thus accommodating all uses and demands, and affording light of a superior quality.

5th. That the heat given off by it is so trifling as to be scarcely perceptible.

6th. That, being sealed within a chamber of glass, it cannot directly communicate fire to anything, and since the amount of heat transmitted by the glass globes is so infinitesimal, a fire can only be caused by long-continued contact with materials of the highest inflammability. It is, therefore, vastly the superior illuminant in the matter of safety from fire.

7th. That when produced upon a scale at all approximating the gas output in a given locality, it can be manufactured and sold at a profit in direct competition with gas.

8th. That the apparatus employed in generating the electricity for its supply may be utilized during non-lighting hours (*i. e.*, the daytime) for the generation of electricity for other purposes, such, for instance, as the supply of electric power; and this in competition with steam or other forces and at such rates as will suffice, in some instances, to cover the whole cost of operating the station for the twenty-four hours, thus leaving the receipts for light as net profit.

THE STOCKHOLDERS AND DIRECTORS SHOULD, AT THE OUTSET OF FORMING AN EDISON ILLUMINATING COMPANY, GET A FEW FACTS FIRMLY FIXED IN THEIR MINDS.

FIRST. An Edison Light Station is an establishment to be so constructed that it will endure for at least a generation.

It is very easy to be led into false economy about the erection, installation and equipment of a station.

Every part and parcel of the building and its machinery, and the entire system, must be absolutely of the best of its kind, so that it may withstand the wear and tear of years of service, with the minimum of expenditure for repairs.

SECOND. *This company makes no profit direct or indirect upon any portion of the Central Station equipment, but is paid for its franchise* **only by** *the* **dividends** *earned upon the local stocks it receives. It is therefore interested to a greater degree in the success of each local company than any other individual stockholder. Other holders may sell their stock, this company does not.*

THIRD. *That the business of an Edison Illuminating Company is to make and sell electric energy, and no company should be satisfied with the revenues from the sale of current for light only. The station which is earning 20 per cent. dividend in selling light, can easily earn an additional 10 per cent. by selling power.*

The maximum average cost on a large scale of producing a horse-power per year is estimated to be from $25 to $40.

There is already an immense market for small motive power, in quantities of from $\frac{1}{8}$ to 15 H. P.

The small manufacturer cannot produce his own steam power at as low a price as he can purchase electric power. The latter can be profitably supplied, and will find ready customers at $100 to $150 per H. P. per year, at which price there is a handsome profit to the company.

THE ELEMENTS OF A SUCCESSFUL GENERAL STATION COMPANY.

I. Absolute reliability is to be obtained only by a thoroughly good installation consisting of duplicate boilers, engines, dynamos, &c., as indicated by this company's specifications.

II. The street system of mains should be loaded with at least 30 per cent. more lamps than the nominal capacity of the station, so that the maximum requirements of consumers will, at the moment of heaviest consumption, be fully up to the maximum capacity of the station.

III. A sufficient amount of house wiring should be done for the best consumers, so that the output of the station at time of starting will yield a revenue more than sufficient to pay operating expenses.

IV. The judicious selection of consumers, whose requirements for light and motive power will so regulate the load, that the output of current will require an average of 75 per cent. of station capacity for every hour the station operates.

V. A liberal but firm and economical business management and a constant and critical supervision of the company's affairs by its Board of Directors.

THE SELECTION OF REAL ESTATE.

This is one of the most important matters with which the Local Company has to deal, and many details in connection therewith must be carefully considered before the final decision is made, as *a mistake* in this matter at the outset, *directly affects* the net *earning capacity* of the station during the entire term of its existence.

We know of one station where the selection was so unfortunate that a new property has been purchased 1,200 feet nearer the centre of distribution, the entire station removed and rebuilt, and a new system of feeders put up, all to overcome the disadvantage under which the station existed in its old location; and of another which will probably soon be changed at a cost of upwards of $100,000.

Primarily the cost of a lot, added to the cost of copper required in the feeders (to carry the current to the mains), determines the actual value of any given piece of property.

The geographical centre is very often not the centre of illumination.

When you get away from this latter centre, the cost of copper increases as the square of the electrical distance, and a lot within 500 feet of the centre may be cheap at an apparently high price, while another, a few hundred feet away, be costly at a very much less price.

In selecting a lot, give careful consideration to the following important matters, which, as they affect the actual operating expenses as long as the station exists, are of vital importance.

WATER FACILITIES.

If possible, get near a stream of good pure water, or in a location where a reliable well of large capacity can be put down for a reasonable figure.

The cost of water (taken from city mains) will average as high as from one and one-half to four per cent. of the total monthly operating expenses of a station.

A good driven or gang well will usually furnish a sufficient water supply for all the boilers in a station. If a surplus supply is obtainable in sufficient quantity, it can be profitably utilized for purposes of condensation, and thus save at least 15 per cent. of the fuel required per horse-power.

COAL TRANSPORTATION.

It is desirable to have the lot so located that the cartage of coal is avoided. If a railroad side track can be laid to the lot, this cost

may be saved. This will often save from $10 to $30 per month in the expense of operating a station.

SOIL.

Solid ground is absolutely necessary, so that substantial foundations may be erected and vibration avoided.

Be sure to avoid swampy or mucky soils, or filled-in ground. The following are desirable, in the order mentioned: **hard gravel, solid earth, rock.**

A corner lot, or one with an entrance to the side or rear, should always be obtained.

By reference to the plans it will be seen that stations of from 900 lights to 1,600 lights capacity can be erected and conveniently arranged on a lot 30 feet by 100 feet; but ample facilities for the delivery of coal and the removal of ashes should be provided.

For stations of larger capacity a lot 50 feet by 100 feet should be selected.

If any doubt exists as to which is the most desirable property for the purpose, we would suggest that a map be sent us showing the location of several available plots, with a description of their advantages and prices, and, after looking over the canvass of the district, we can readily determine which is the best selection.

STATION BUILDING.

This should be of the most substantial character. Nothing less durable than a well-constructed brick building should be used.

It is false economy to put up a cheap frame building to effect a saving in *first cost.*

A building of this kind can only last a very few years under the most favorable conditions, and is always liable to destruction from fire.

ENGINES.

After years of experience in the business of electric lighting, we are firm advocates of high-speed engines.

In a spirit of fairness, we have during the past two years endeavored to pursue a liberal policy in our Central Station practice, and have permitted the use of such high-speed engines as might be selected by each local company. The results show that the policy

has not been a wise one, and such local companies as have adopted engines heretofore untried in our business, now find that their stations cost more in operating expenses for *coal, oil, water and repairs, etc.*, than stations using engines specified by us.

HIGH SPEED VS. SLOW SPEED FOR ELECTRIC LIGHT STATIONS.

The Edison Company were the pioneers in adapting high-speed engines to Electric Lighting.

The success of our methods has induced many rivals to follow in our footsteps. Others have, however, contended that we were wrong.

For reliable and economical Central Station Service in engine power, several important features are absolutely essential.

1st. The most direct application of engine power to dynamo pulley, without the intervention of unnecessary shafting and belting.

2d. Several small units, which taken together make up the maximum power, and taken separately enable the station production of even the minimum of current to be obtained with high economy.

These small units also enable us to increase or decrease the station output on very short notice.

3d. The minimum of investment to secure the maximum of power supplied to the pulley of the dynamo.

The strongest reason urged in favor of slow-speed engines is the saving in coal; but it must be evident even to the most casual observer that coal is not an all-important item of the cost of operating a station.

Our statistics show that the cost of coal is only from 13 per cent. to 20 per cent. of the cost of station operation; therefore, the slow-speed engine must make its saving on this percentage of operating expenses.

When we came to the discussion of the Engine Question for our large Up-town Stations in New York City, we assumed that here the scale of operations would be sufficiently large to warrant the use of slow speed engines, providing the showing for economy was in their favor.

We made an exhaustive analysis and examination of the whole subject, and when we came to balance the saving in fuel, added to the interest on extra investment in a slow speed plant, against the extra quantity of fuel used by high speed, together with the matter of facility of quick expansion and contraction of output, we found the results in dollars and cents in favor of high speed.

Our Committee on this subject was composed of competent and expert men with outside consulting engineers, favoring no particular class of engines, and the vote with one exception was in favor of high speed.

This Company therefore finds, after six years' practice:

FIRST. That high speed engines are the most economical, reliable and generally best adapted for Central Station Service; and

SECOND. That its position on the question is sustained by a competent expert tribunal after an exhaustive investigation and consideration of all the elements in the problem.

It is in fact the true and only way to closely approximate a reservoir or storage of electricity.

WATER-POWER STATIONS.

We now have several Central Station Companies where the dynamos are driven by water power; they are counted among our most successful companies, and are regularly earning dividends of 20 per cent. and upwards.

The character of the water power, its distance from the centre of electrical distribution, its constancy and reliability at all seasons of the year, the quantity of water per minute, the height of fall, etc., are all points of vital importance, which must be carefully investigated previous to closing any contract for this kind of a station.

It is a difficult matter to get perfect regulation and an even pressure of current when the dynamos are driven by water power. As in a steam-power station where the type of engine in a large measure governs the regularity of the current, so in a water-power station, the kind of water wheel has everything to do with attaining the same object.

We do not, under any circumstances, recommend either the over-shot, the under-shot, or the breast wheel; it has never, in all our experience, been found possible to properly govern these wheels.

We have tried certain classes of turbine wheels which have proved to be perfectly satisfactory and we consider them to be the most susceptible to perfect regulation.

Calculations should never be made for using less than two wheels; in cases where there is liability to shortage of water in the summer season, an engine and boiler may be installed as reserve power.

We are prepared to furnish special plans for the application of power in stations of the above character, and advise that all the conditions be laid before us, previous to closing negotiations and proceeding with work.

It often happens that excellent water power is available at some considerable distance from the centre of a town. In such cases, and where the power can be procured very cheaply, the current can be economically delivered at a greater distance than where steam is used.

REPAIRS.

Where a Central Station plant is constructed in a proper manner, and is composed of first-class boilers, engines and dynamos, and these are set up in

the manner prescribed by this company, and handled and operated by competent men, there is no reason why the cost of repairs should for many years be greater than in old established manufacturing plants employed in other industries.

In order to get some definite information on these matters, we have carefully inquired of all our Local Companies as to what amounts they have expended in repairs *since the starting of their stations.*

BOILER REPAIRS.

In eighteen stations the total cost of repairs has been **one per cent.** on the value of the boilers. As the boilers are a part of the apparatus more liable to depreciation from ordinary wear than either engines or dynamos, we always estimate ten per cent. for depreciation and repairs.

ENGINE REPAIRS.

It is a well-known fact, that the older school of engineers who are wedded to slow-speed engines have placed the argument against the use of high-speed engines that, because they run so fast, they would wear out sooner, and must be repaired oftener.

While we freely admit this to be a fair argument, and one which would fully apply to that class of high-speed engines which are built to look well, sell for the least money, and are composed of the poorest materials and workmanship, we hold that it does not apply at all to the best class of high-speed engines.

In all of the stations from which we have reports, we find that the total cost of repairs to engines since the stations started has *only been* **one and one-half** *per cent.* of the total cost of the engines.

The major part of this expense has been concentrated in two stations, and where these abnormal conditions are not counted, the cost is reduced to **less than one-half of one** per cent. When properly cared for, we estimate the entire cost of depreciation and repairs on engines to be not more than 5 per cent. per year.

REPAIRS ON DYNAMOS.

To the inexperienced person the dynamo-machine is a mystery; the high speed at which it operates leads the non-expert to believe that the wear and tear must be excessive; but to the experienced mechanic it is at once apparent that the armature is the only moving part, and that all the wear is concentrated in the two bearings, and at the commutator.

We admit that accidents have happened to our dynamos, and that occasional repairs have been made.

The total cost of repairs of all kinds is only .0131 *per cent. of the value of the dynamos.*

We find that the Babbitt bearings are good for five years' service; that the commutator will, with good care, last at least three years, and that a set of brushes will, with proper attention, last six months.

We estimate the average depreciation and repairs on dynamos to be not more than three per cent. per annum.

DESCRIPTION OF STREET SYSTEMS.

It is important that the Agent carefully describe and explain the difference between the *feeders* and *mains* of a system of street conductors.

The Mains are the conductors which ramify throughout all portions of the district to be served with current, and are those conductors from which the supply of electricity is delivered to the consumer; all lamp services are taken from the mains.

The Feeders are the heavy conductors leading direct from the station to specified points on the mains, and conduct all the current to the latter. Lamp services must never be taken from the feeders.

POINTS OF ADVANTAGE OF THE EDISON "THREE-WIRE" SYSTEM.

Two absolute essentials in any system of electric lighting upon a comprehensive scale never to be lost sight of are as follows:

1st. An independent unit of light, i. e., each lamp independent of every other.

2d. The least possible investment in conductors consistent with the possession of an independent light unit and with safety and reliability.

This was solved by Mr. Edison in the invention of his "3-Wire" System, in which is employed a higher electrical pressure for the exterior than is employed for interiors, and which yet affords an absolute individuality of each lamp.

The original "Multiple Arc," or "Two-Wire" method of distribution required copper in the conductors in the proportion of 100 to 37½ in the present.

The (so-called) "3-Wire" System is in reality not confined to the use of three wires; four or five, or even a greater number, may be employed, and each added wire bring a material reduction of the weight of copper required. But the first great reduction effected in the diminution from 100 to 37½ cannot be paralleled; and it has been found that even in 24,000-light stations there would result no advantages from the further extension of the principle. From this the deduction is clear that in the 3-Wire System we have the lowest investment in conductors consistent with the first and most important requirement of independent light units.

The history of the art the past five years likewise affords ample proof of this, in that the Edison 3-wire stations are unique in their practical and commercial success. All other methods of distribution upon a large scale have proven absolute failures.

An exhaustive examination and analysis of the whole subject of electrical distribution from central stations had for the purpose of deciding upon the specifications for the three new stations of 24,000 lights each, now in course of preparation in New York City, resulted in the unanimous confirmation of the "3-Wire" System.

This Company therefore offers as its recommendation for the immediate future the "3-Wire" System as the only one yet found practicable and commercially successful.

OVERHEAD POLE LINES.

A large number of our stations supply current through overhead or pole line circuits.

This method has been adopted because of the reduced cost of original installation, but we consider it lacking in that element of permanency, which is of the utmost importance in the economical maintenance of the plant.

The choice between the overhead and underground plans should be determined by the feeling of the people regarding heavy pole lines in or near the principal streets, the existence of present lines, or rows of trees, the feasibility of placing poles on private land, along the rear lines of private property, and the prospective size of the system. Very few cities can be adequately served by overhead systems. Housetops should be avoided, and poles, when used, should be only from 90 to 110 feet apart, for heavy lines carrying feeders. The overhead conductors, if adapted to the place, will cost from one-quarter to one-third as much as the underground.

UNDERGROUND CONDUCTORS.

The Edison System of Underground Electric Tubing is used by many stations in this country, and also in foreign countries. *There are now fifty-four miles of this system in daily use*, equal to one hundred and sixty miles of ordinary cable.

The conductors are thoroughly insulated, and enclosed in heavy wrought iron tubes; special provision being made for perfect electrical connections throughout.

The Edison system of underground conductors is based upon the principle of "sectional construction," the lines being made in the factory in sections, each complete in itself, the work of construction in the trench being confined to joining the completed sections together.

The iron tubes are used in lengths of twenty feet, and in the completed sections as made in the factory.

The street joints between successive sections are thus at distances of twenty feet or some multiple of twenty feet apart, according to circumstances, and are enclosed in cast iron boxes fastened to the tubes and filled with insulating compound.

In a line so constructed the contained continuous cable, of jointed sections, is completely surrounded by a tough, adhesive, elastic, waterproof, insulating compound. This complete filling of all interstices with solid insulation is made possible by the method of manufacture in short sections, whilst from the comparative frequency of the joints so necessitated, and the method of making them, it results that at practicably any point in a district, the set of service wires planned for that district may be readily reached.

(Sectional view of Edison 3-wire electric tube.)

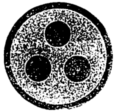


Fig. 23.

This system of underground conductors permits of great flexibility in making circuits, using a wide range in sizes and capacity of conductors.

All electrical connections are made by means of flexible copper cables; this method of making joint is shown in Figures No. 24 to 26:

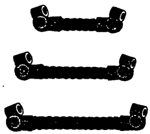


Fig. 24.

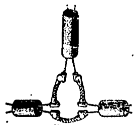


Fig. 25.

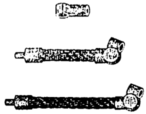


Fig. 26.

These junctions are enclosed in cast-iron boxes shown in Figure No. 27.

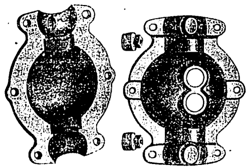


Fig. 27.

The boxes are joined to the tube by a special form of ball and socket joint shown in Figure No. 28.

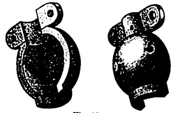


Fig. 28.

The joints made up, and the box in position ready for filing with compound, is shown in Figure No. 29.

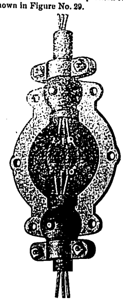


Fig. 29.

Figure No. 30 shows the form of a T-coupling joint, and branch, with box used for covering.

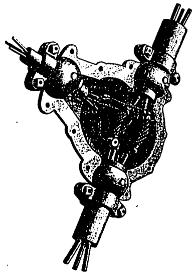


Fig 30.

All the details of this system of conductors have been elaborately worked out, and comprise all the different sizes necessary for every portion of the work.

The method of laying and tapping for private dwellings is very complete, and affords perfect protection against lightning.

We do not claim for this system that it is exceptionally cheap in first cost, but the Edison System has been designed throughout with especial reference to durability, rather than economy in first cost.

After four years' experience with this system of underground conductors in different parts of North and South America, Europe and Australia, we have no hesitation in saying it is the best and most efficient now before the public.

A COMPROMISE SYSTEM.

This plan contemplates the laying of all the **feeder conductors** underground (sometimes also including the most important of the

main conductors), and the general system of mains erected on poles.

With this arrangement the heaviest copper is laid underground and is safe from accidental damage, and the smaller and lighter wires only are on poles, thus rendering the system less objectionable on the score of appearance.

We have several stations using this plan and it proves to be very satisfactory; it also in a measure meets the demand of underground wires, without a too great cost.

METHOD OF SELLING LIGHT.—METER SYSTEM AND CONTRACT SYSTEM.

"Shall we sell the light by meter or contract?" is one of the leading questions asked by Local Companies.

We reply that both systems have their special advantages.

THE EDISON METER IS RELIABLE, AND THE METER SYSTEM NOT EXPENSIVE TO HANDLE, WHEN IT IS PROPERLY DONE BY PERSONS WHO WILL EXERCISE ORDINARY CARE, AND WHEN ANY CONSIDERABLE NUMBER OF THEM ARE USED.

IN OUR JUDGMENT IT IS THE MOST SATISFACTORY AND RELIABLE METHOD BOTH TO THE CONSUMER AND THE COMPANY; WE WOULD NOT RECOMMEND ANY OTHER METHOD TO LARGE COMPANIES.

The contract system has developed one element of weakness: it has been the general complaint that consumers would keep lamps burning for many hours longer than had been agreed upon with the company, thus increasing the quantity of coal consumed, and also the lamp breakage, without corresponding return to the company.

By a change in the terms of the contract already made by some companies, whereby the consumer is charged for lamps broken, we anticipate that this element of weakness will, to a certain extent, be eliminated.

As soon as the consumer has a moneyed interest in the consumption and life of the lamp, he will tend to economize in its use.

The contract system gives a Local Company a strong basis on which to compete with gas and enables it to secure customers rapidly on about the same basis as former gas bills have averaged.

A clear contract for the purchase and sale of the light, enables the company to closely estimate their monthly profits, and the consumer always knows how much his light will cost him per month.

For small companies this system possesses the advantage of avoiding the expenses of the outfit of meters and appliances, and of reducing operating expenses in this department.

We have many successful companies selling light by each method.

FREE WIRING.

WE STRONGLY ADVISE EVERY LOCAL COMPANY TO WIRE AT ITS OWN EXPENSE A SUFFICIENT NUMBER OF FIRST CUSTOMERS, TO AFFORD SUCH A REVENUE AS WILL YIELD A PROFIT FROM THE FIRST STARTING OF THE STATION.

This shows confidence on the part of the Local Company, it is a special inducement, and enables the company to secure good contracts with desirable consumers, for terms of from one to five years, and the added investment is not great.

RATES FOR SELLING EDISON LIGHT.

We do not advise that the light be offered at a lower rate than gas, except in extreme cases where gas is very high in price.

The main arguments in favor of our light are its superior quality, its safety from fire, its greater brilliancy, absence of heat, freedom from noxious vapors, freedom from deposits so destructive to decorations, &c., and for these reasons its better adaptability as an artificial illuminant, and its wider range of application in all positions and for all purposes that artificial light may be needed.

By virtue of these points of superiority, even though selling nominally at the same price as gas, it is really much cheaper.

We give the following tables of rates of several companies, both on contract and meter basis:

HAZELTON, PENNA.

Meter........... ....1¼c. per hour per 10 c. p. lamp.

TAMAQUA, PENNA.

Commercial:	7 O'clock.	9 O'clock.	Midnight.	All Night.
10 c. p. lamp..	$0 50	$0 60	$0 75	$1 00
13 c. p. "	0 60	0 75	1 00	1 30
16 c. p. "	0 75	1 00	1 25	1 60
32 c. p. "	1 50	2 00	2 50	3 20
50 c. p. "	2 25	3 00	3 75	4 50

Domestic:	10 c. p. Lamp Standard.
1 lamp..	75c. per month each.
2 lamps...	50c. " "
3 "	40c. " "
4 "	20c. " "
5 "	15c. " "

And 10c. per month for every additional lamp.

ASHLAND, PENNA.

13 c. p. lamp. .... $0.42 per month.
16 c. p. " .... 0.50 per month.
32 c. p. " .... 1.00 per month.
New lamps paid for by consumers.

MOUNT CARMEL, PENNA.

Meter.. 1¼c. per hour per 10 c. p. lamp.
Contract.. 75c. per month per 10 c. p. lamp.

Outside Lights:
$1 50 per month per 10 c. p. lamp.
2 00 per month per 16 c. p. lamp.
3 00 per month per 32 c. p. lamp.

SHAMOKIN, PENNA.

Meter.. 1¼c. per hour per 10 c. p. lamp.

Street Lighting:
$1 25 per month per 10 c. p. lamp.
2 00 " " " 16 " "
3 00 " " " 32 " "

SUNBURY, PENNA.

Contract:
$0 70 per month per 10 c. p. lamp.
0 80 " " " 13 " "
1 00 " " " 16 " "
2 00 " " " 32 " "

WILLIAMSPORT, PENNA.

Commercial:

	Till 9 P. M.	Midnight.	All Night.
10 c. p. lamps	$0 50	$0 75	$1 25 per month.
13 " "	0 60	1 00	1 50 " "
16 " "	0 75	1 10	1 75 " "
20 " "	1 00	1 50	2 50 " "
24 " "	1 25	1 75	3 00 " "
32 " "	1 50	2 00	3 50 " "
50 " "	2 50	3 50	5 00 " "
100 " "	5 00	7 50	10 00 " "

Domestic, 10 c. p. lamps the standard:
First three.. 50c. each per month.
For each over 3 and not exceeding 10.................. 30c. per month.
" " " 10 " " " 20.................. 20c. " "
" " " 20 " " " 30.................. 15c. "
" " " 30 " " " 100.................. 10c. " "
Lamps paid for by consumers.

HARRISBURG, PENNA.

Commercial.

	10 P. M.	Midnight.	All Night.
Each 10 C. P. Lamp	$0 75	$1 00	$1 25 per Mo.
" 13 "	0 95	1 25	1 50 "
" 16 "	1 15	1 50	1 75 "
" 32 "	2 25	2 75	3 50 "

Domestic.

3 10 C. P. Lamps	$24 00 per year	($2 00 per month)
4 " "	30 00 "	(2 50 ")
5 " "	35 00 "	(3 00 ")
6 " "	39 00 "	(3 25 ")
7 " "	42 00 "	(3 50 ")
8 " "	44 00 "	(3 75 ")

For each additional Lamp to 20 .... $1 00 per Lamp per year

For each additional Lamp above 20 .... 75 per Lamp per year.

BELLEFONTE, PENNA.

Rates for Dwellings.

For 1 ten candle-power Lamp	$0 65 per mo.
" 2 " Lamps, or their equivalent	1 30 "
" 3 " " "	1 50 "
" 4 " " "	1 60 "
" 5 " " "	1 65 "
" 6 " " "	1 70 "
" 7 " " "	1 76 "
" 8 " " "	1 84 "
" 9 " " "	1 92 "
" 10 " " "	2 00 "
" 11 " " "	2 08 "
" 12 " " "	2 16 "
" 13 " " "	2 24 "
" 14 " " "	2 32 "
" 15 " " "	2 40 "
" 16 " " "	2 46 "
" 17 " " "	2 52 "
" 18 " " "	2 58 "
" 19 " " "	2 64 "
" 20 " " "	2 70 "

For each additional ten-candle capacity, 5c. per month. Original outfit of lamps furnished by the company free. Renewal lamps to be paid for by consumer at cost. Ten-candle Lamps, 50c. each.

EFFECT OF EDISON LIGHT ON PRICE OF GAS.

STATION.	Price of Gas before Company was organized.	Present Price of Gas.
Appleton, Wis.	$2 85	$2 00
Brockton, Mass	2 75	2 00
Bellefonte, Pa.	3 00	2 00
Cumberland, Md.	2 50	1 75
Des Moines, Iowa	2 50	2 10
Hazleton, Penna.	3 25	2 50
Fall River, Mass.	2 50	2 00
Lawrence, Mass.	2 25	1 60
Middletown, Ohio	3 25	1 50
Newburgh, N. Y.	2 25	1 80
Piqua, Ohio	2 00	2 00
Tiffin, Ohio	2 50	2 00
York, Penna.	2 00	2 00
West Chester, Pa.	2 70	2 50
Average	$2 50	$1 90

Average reduction, 26%.

PREPARATION OF MAP AND CANVASS OF TOWN.

An accurate city or town map should be secured, showing all the blocks, streets and alleys of the district which it is proposed to transverse.

This map should be accurately copied on tracing cloth on a **scale of 100 feet to the inch.**

The names of all the streets and alleys should be distinctly written in their proper places.

When this is done the face of each block should be divided off into sections of one hundred feet front, and the fractional part thereof as the blocks may measure.

It is important that the map be accurately made to the scale we have stated, and that great care be exercised in the correctness of details.

If either or both sides of the street are obstructed by trees it must be so indicated on the map.

The character of the soil—rock, sand, gravel earth—should be noted for each street; also the kind of pavement.

If any restrictions exist, or are likely to appear against the right of way for underground conductors or overhead system *in any par-*

ticular streets, a note must be made of it on the map; in fact the right of way should be secured, and endorsed on the map. If an overhead system is used, it is very desirable to erect it in the alleys and side streets, as far as possible.

CANVASSING.

A personal visit should be made in each building, between the hours of 5 and 9 P. M., and the AVERAGE *number of lamps in use at any one time* carefully noted; that is to say, buildings whose occupants will be desirable customers.

The records should be made in a note book, so that they may be easily transferred to the map without error.

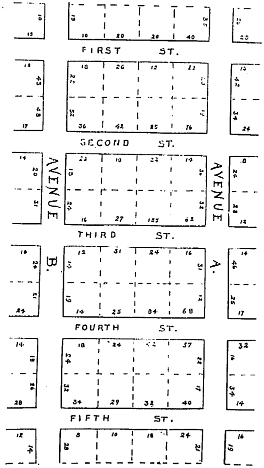
The canvass having been completed, the number of lamps per 100 feet front on each side of each street should be noted on the map.

The map and canvass having been prepared as above directed, it should be endorsed and approved by the officers of the Company and the Board of Directors, and the map is then ready to forward to us for the electrical determination.

This is important work, but can be as well done by local people as by ourselves, and at a small fraction of the cost.

With this map in our possession, the making of our accurate estimate is a comparatively short and simple matter.

The following illustration shows section of a completed map:



ESTIMATES FOR COST OF PLANT AND CAPITALIZATION OF LOCAL COMPANIES.

CAUTION.

To name an *exact price* at which this company will install a plant, will in every case necessitate a careful survey of the district to be lighted, and an accurate estimate and determination by our Engineering Department.

The estimates furnished in the following pages have been prepared with great care, and with a careful application of our experience, derived from the construction and operation of all the central stations now in existence, and they are as nearly accurate as it is possible to provide, yet they are merely approximate estimates, and must not be construed as offers for the cost and construction of any station, but as a guide for the agent in arriving at the amounts of capital requisite for a station of a given size with a reasonable degree of accuracy, and thereby to effect the organization of a company and secure the necessary subscriptions to the stock, before going to the expense of making the final survey and determinations.

The agent will readily understand that if the Local Company elect to make their own purchases of these supplies, and contracts for the work, that some saving may possibly be made on our estimate of cost. *But in any event the materials and workmanship must all be in accordance with our specifications and subject to our inspection.*

The itemized details of these estimates will be supplied in all cases where a local company is organized and prepared to execute their contracts.

We append one estimate in full detail, showing all the different items:

The Edison Company have spent a large amount of capital in perfecting their system of Central Station Lighting, and have also carefully accumulated accurate statistics, and data, and much valuable experience from the large number of stations already installed and in operation.

It earnestly desires that each new company shall, as far as possible, have the full benefit of all the knowledge possessed by the home office.

Our estimates, specifying in detail the itemized list of all the supplies of machinery and parts which make up a central station equipment, are prepared with great care and from the combined knowledge of the best experts engaged in our business.

We consider that every piece of machinery specified is absolutely essential to the reliability, safety and economical operation of a station.

As stockholders in each local organization we have given careful attention to all of these matters, because excessive depreciation effects direct reduction in our dividends, and with all these things in mind, we have prepared our specifications with all possible care, and we believe with a liberal spirit of fairness.

ESTIMATE No. 1.

STATION CAPACITY {960 10 C. P. Lamps, or 600 16 C. P. Lamps.

CAPITAL		$35,000
Inside System, Lamps connected		1,200 10 C. P. Lamps
DISBURSEMENT OF CAPITAL		$35,000 00
Street System	$4,290 00	
Inside System	2,901 00	
Boilers, Pumps, &c.	3,184 50	
Engines, &c.	2,991 21	
Dynamos	3,185 60	
Electrical Apparatus	1,314 38	
Meters and Meter Appliances	1,232 08	
Sundry Tools	436 74	
Extra Parts	859 58	
Inspection, Map, Electrical Determination, &c.	605 00	
	$21,003 09	
REAL ESTATE	800 00	
BUILDING	2,000 00	
30% to Edison Co.:		
5% Cash	1,750 00	
25% Stock	8,750 00	
Cash in Treasury	696 91	
		$35,000 00

ESTIMATE No. 2.

STATION CAPACITY {1,280 10 C. P. Lamps, or 800 16 C. P. Lamps.

CAPITAL		$40,000
Inside System, Lamps connected		1,500 10 C. P. Lamps
DISBURSEMENT OF CAPITAL		$40,000 00
Street System	$5,362 50	
Inside System	3,630 00	
Boilers, Pumps, &c.	3,581 90	
Engines, Piping, &c.	3,338 28	
Dynamos, Lamps, &c.	4,151 40	
Electrical Apparatus	1,350 29	
Meters, &c.	1,477 26	
Sundry Tools	436 79	
Extra Parts	1,025 09	
Inspection, Maps, Electrical Determination, &c.	825 00	
	$25,181 51	
REAL ESTATE	800 00	
BUILDING	2,000 00	
	$27,981 51	
30% to Edison Co.:		
5% in Cash	2,000 00	
25% Stock	10,000 00	
Cash in Treasury	18 49	
		$40,000 00

ESTIMATE No. 3.

STATION CAPACITY {1,600 10 C. P. Lamps, or 1,000 16 C. P. Lamps.

CAPITAL		$50,000
Inside System, Lamps connected		2,000 10 C. P. Lamps
DISBURSEMENT OF CAPITAL		$50,000 00
Street System	$6,600 00	
Inside System	5,000 00	
Boilers, Pumps, &c.	4,090 90	
Engines, Piping, &c.	3,976 37	
Dynamos, Lamps, &c.	4,946 70	
Electrical Appliances	1,647 13	
Meter and Meter-Room Sundries	1,737 75	
Sundry Tools	436 71	
Extra Parts	1,875 48	
Inspection, Map, Electrical Determination, &c.	1,100 00	
	$30,861 07	
REAL ESTATE	1,000 00	
BUILDING	2,500 00	
	$34,361 07	
30% to Edison Co.:		
5% Cash	2,500 00	
25% Stock	12,500 00	
Cash in Treasury	638 93	
		$50,000 00

ESTIMATE NO. 4.

STATION CAPACITY {1,920 10 C. P. lamps, or 1,200 16 C. P. lamps.

CAPITAL		$57,000 00
Inside System Lamps connected		2,400 10 C. P. Lamps.
DISBURSEMENT OF CAPITAL		$57,000 00
Street System	$7,920 00	
Inside System	5,910 00	
Boilers, Pumps, &c	4,714 38	
Engines, &c	4,435 07	
Dynamos	5,819 80	
Electrical Apparatus	1,056 56	
Meters, &c	1,907 31	
Sundry Tools	436 74	
Extra Parts	1,541 58	
Canvass, Map, Inspection, &c	1,320 00	
	$36,021 44	
REAL ESTATE	1,000 00	
BUILDING	2,500 00	
	$39,521 41	
30% to Edison Company:		
5% Cash	$2,850 00	
25% Stock	14,250 00	
Cash in Treasury	378 56	
		$57,000 00

ESTIMATE NO. 5.

STATION CAPACITY {2,560 10 C. P. lamps, or {1,600 16 C. P. lamps.

CAPITAL		$70,000 00
Inside System, Lamps connected		3,200 10 C. P. Lamps.
DISBURSEMENT OF CAPITAL		$70,000 00
Boilers, Stacks, &c	$5,195 30	
Engines, Piping and Belting	5,503 08	
Dynamos, Lamps and Regulators	7,535 00	
Electrical Appliances	2,190 75	
Meters, &c	2,310 80	
Sundry Tools	436 74	
Extra Parts	1,887 38	
Inside Wiring	7,920 00	
Street System	10,560 00	
Canvass, Inspection, &c	1,650 00	
	$45,188 55	
REAL ESTATE	1,200 00	
BUILDING	2,500 00	
	$48,888 55	
30% to Edison Company:		
5% Cash	3,500 00	
25% Stock	17,500 00	
Cash in Treasury	111 45	
		$70,000 00

ESTIMATE NO. 6.

STATION CAPACITY {3,200 10 C. P. lamps, or {2,000 16 C. P. lamps.

CAPITAL		$90,000 00
Inside System, Lamps connected		4,000 10 C. P. Lamps.
DISBURSEMENT OF CAPITAL		$90,000 00
Boilers, Stacks, &c	$6,898 74	
Engines, Piping, &c	6,257 90	
Dynamos, Lamps, &c	9,288 40	
Electrical Appliances	2,502 71	
Meters, &c	2,722 93	
Sundry Tools	437 92	
Extra Parts	2,315 09	
Inside Wiring	9,000 00	
Street System	13,200 00	
Inspection, &c	1,960 00	
	$55,573 69	
REAL ESTATE	1,800 00	
BUILDING	3,000 00	
	$60,373 69	
30% to Edison Company:		
5% Cash	4,500 00	
25% Stock	23,500 00	
Cash in Treasury	1,626 31	
		$90,000 00

Estimates for stations of larger capacity for special cases will be furnished upon application to our Engineering Department.

DETAILS OF ESTIMATE No. 3 FOR THE ERECTION AND EQUIPMENT OF A 1600 10-CANDLE POWER LIGHT EDISON CENTRAL STATION.

Boilers, Stacks, Pumps, etc.:

Item	Amount
2 Steel Horizontal Tubular Boilers, 60 inches diameter by 16 feet long with eighty 3-inch tubes	
2 Complete Setting of 2 Horizontal Tubular Boilers, with Jarvis Furnace	
Transportation on Boilers	
Cartage and Handling to deliver Boilers at Building	
Handling and Placing Boilers in position	
1 Iron Smoke Stack, 38 inches diameter by 80 feet high	
Cartage and Delivery of same	
Foundation for same	$4,090 90
Hoisting and Placing same with guy rods	
1 6x4x6 Worthington Boiler feed Pump	
Foundation for same	
1 No. 8 Korting Injector	
1 No. 12 National Feed Water Heater	
Foundation, and Setting same	
1 Exhaust Condenser and Muffler	
Steam Gauge for Engine Room, 10-inch Dial	
	$4,090 90

Engines, Piping, Belting, Foundations, &c.:

Item	Amount
2 Engines with cylinder, 12 inches diameter by 12 inches stroke, with two driving pulleys, 60 inches diameter by 11 inches face; speed, 282 revolutions per minute	
Freight, Cartage and Handling, and Placing same on foundations	
2 Foundations for 12 by 12 Engine complete	$3,976 37
All necessary Steam, Exhaust, Water, Drips, Blow-off, Piping, &c.	
Freight, Cartage and Handling of Pipe and Fittings	
168 feet 9-inch Double Endless Belt	
	$3,976 37

Dynamos, Lamps, Dynamo Regulators, &c.:

Item	Amount
4 Dynamos, No. 10; Combined Capacity, 800 Amperes; or 1,600 lamps of 10 Candle Power Each	
4 Base Frames and Foundations for 4 Dynamos, No 10	
Cost of Freight, Cartage and Delivery of Dynamos	
Labor Setting up Dynamos	$4,946 70
1,000 10 C. P. Lamps	
800 Test Lamps	
4 Hand Regulators for 4 Dynamos, No. 10	
	$4,946 70

Electrical Appliances for Testing and Regulation:

1 Board and Wiring for Bank of Test Lamps, with Plug Switches attached	
8 Feeder Equalizers	
2 Standard Pressure Indicators	
6 Comparative Pressure Indicators	
4 Dynamo Switches for Changing Circuits, No. V65	
1 Main Balancing Ampere Indicator, No. V67	
1 Main Ampere Indicator to Show Load, No. 108	
1 Testing Galvanometer and Battery	$1647, 13
1 Board and sockets, Wiring and Switches for Meter Test	
1 Lightning Arrester, No. 100, with Special Switch and six Plugs	
1 Ground Detector, No. 1029	
1 Breakdown Switch, No. 1717, with 450 Ampere Capacity	
Sundry Electrical Appliances	
1 Standard Volt Meter	
4 No. 272 Dynamo Ampere Meters for 4 No. 10 Dynamos	
Freight, Cartage and Handling	
	$1,647 13

Meter and Meter Room Sundries:

90 Meters for Six Lights	
60 Meters for Twelve Lights	
20 Meters for Twenty-five Lights	
5 Meters for Fifty Lights	
1 Meter for One Hundred Lights	
Analytical Balance for Weighing Meter Plates	
2 Glass Funnels, one Six Inches Diameter and one Eight Inches Diameter	
2 Hydrometers, Special, and one Thermometer, 220° Fahrenheit	
1 Dozen Assorted Test Tubes and Stand for Holding Same	
1 Druggist Scale with Tin Scoop	
1 Nickel-Plated Counter Cock	
Enameled Sink, 30x18x6, with Bowe's Patent Trap and Glass Chamber	$1,737 75
2 One-Gallon Bottles, Clear Glass	
1 Graduated Eight-Litre Bottle, Clear Glass	
1,000 Lead Seals and Sealing Tools	
30 Lbs. Zinc Sulphate	
15 Lbs. Distilled Mercury	
16 Ounces Fine Asphalt Varnish	
1 Supply of Chemicals	
1 Carboy for Distilled Water	
One-half Dozen Reagent Bottles	
180 Extra Assorted Meter Bottles, Plates and Rubbers	
Freight, Cartage and Handling	
	$1,737 75

Sundry Tools, etc., for Boiler and Engine Room:

1 Tubular Steel Wheel Barrow, 250 lbs. Capacity	
2 No. 3 Steel Scoop Shovels	
1 Set Furnace Slice Bars, Hoes and Rake, Two of Each	
Fine Brush and Handle	
25 Feet Sprinkling Hose and Nozzle ¾-inch	
1 Cast-Iron Sink, 16x30x6	
1 Ladder, 14 Feet Long	
4 Galvanized Iron Water Pails	
1 Double Dial Speed Indicator (Electric Mfg. Co.'s)	
1 Bench Vise	
6 Assorted Files and Handles	
2 Monkey Wrenches, one 8-inch and one 12-inch	
1 Chain Pipe Tongs	
2 Stillson Pipe Wrenches, one 8-inch and one 12-inch	
1 Machinist's Hammer	
6 Assorted Cold Chisels	
1 Axe	$436 74
1 Double Oil Cabinet	
1 Oil Filter	
50 Lbs. Cotton Waste	
1 Bbl. Vacuum Co.'s Elec. Mach. oil	
1 Bbl. Vacuum Co.'s No. 600 W. Cyl. Oil	
2 Sets Nickel-Plated Engine Oilers	
2 Scrapers for bearings	
2 Screw Drivers, Assorted	
2 Oil Filler's Cans	
1 Pick-axe, 1 Spade, 1 Shovel, 1 Crowbar	
1 Set Lineman's Tools, 1 Pair Pole Climbers, 1 Hatchet	
1 Strap and Vise, 100 feet ¾-inch Rope, and 1 Pair Stubbs Cutting Plyers, 8-inch	
2 Speed Indicators Attached to Engine, 6¾-inch dial	
Freight and Cartage	
Felt Covering on Steam Piping	
	$436 74

Extra Parts for Engines and Dynamos:

1 Extra Armature for No. 10 Dynamo	
1 Set Babbitt Shells for No. 10 Dynamo	
12 Extra Brushes	
1 Pair Extra Brush Holders	
900 Extra 10 C. P. Lamps	
700 Extra 16 C. P. Lamps	
1 Extra Endless Belt, 9 inches wide by 38 feet long	
1 Extra Endless Belt, 9 inches wide by 47 feet long	$1,375 48
1 Valve Rod and Valve, for 12x12 Engine	
1 Eccentric Rod, for 12x12 Engine	
1 Eccentric Strap, for 12x12 Engine	
1 Cross-Head, for 12x12 Engine	
1 Pair Boxes for Each End of Connecting-Rod, for 12x12 Engine	
1 Set Straps and Bolts, for Both Ends, for 12x12 Engine	
Freight and Cartage	
	$1,375 48

Interior Wiring and Service Connections to Buildings:

All Necessary Wire, Cleats, Mouldings, Safety Devices, Switches, Key or Keyless Sockets, Pliable Conductors, Shades and Holders, Switches, Labor, Etc., Etc., Etc., to Wire First Customers, for 2,000 Lamps, at $2.50 per Lamp...	$5,000 00

Street Installation:

All necessary Poles, Wire, Cross-arms, Etc., together with all Labor of running and putting up, for 2,000 Lamps, at $3.30....	$6,600 00

Canvassing and Starting Station, Instruction, Labor and Inspection:

Cost of Canvass and Estimates, Expenses of Foreman, Engineer, Electrical Report, Railroad Fares, Incidentals, Etc.....	$1,100 00

RECAPITULATION.

Boilers, Stack, Pumps, Etc.	$4,090 90
Engines, Piping, Belting, Etc.	3,976 37
Dynamos, Lamps, Dynamo Regulators, Etc.	4,916 70
Electrical Appliances for Testing and Regulation	1,647 13
Meters and Meter Room Sundries	1,737 76
Sundry Tools, Etc., for Boiler and Engine Room	436 74
Extra Parts for Engines and Dynamos	1,375 48
Inside Wiring and Service Connections to Buildings	5,000 00
Street Installation	6,600 00
Canvassing, and Starting Station, Instruction, Labor and Inspection..	1,100 00
Total	$30,861 07

We invite the particular attention of agents to some important matters in connection with these revised estimates.

We have so arranged our new plans as to divide the immediate or ultimate capacity of the station into engine and dynamo *units* of *equal capacity*.

This arrangement uses boilers, engines and dynamos of duplicate sizes, reduces the first cost of installation, and by having all parts alike the reliability of the station is greater and repairs in case of accident more promptly made, with less expense.

The improvements made in the manufacture of dynamos, engines and electrical apparatus have greatly increased their reliability.

The careful inspection and supervision applied by us during the construction of the station and street system secures the continual improvements so essential to the perfection and healthy growth of a new business.

By reference to the load diagram, Fig. 208, it will be observed that the practical service of a station requires the use of the maximum capacity for only about two hours per day, of its double plant for a total of about five hours, and of one unit for the balance of the time.

OPERATING EXPENSES, EARNINGS AND DIVIDENDS.

If the promoters of a company will furnish us with the fullest information and conditions under which a station can be started, we will ascertain at the outset whether or no the conditions are favorable, and if they are, we will so inform them and *vice versa*.

The following tables are not estimated, neither are the figures specially prepared for this book, but they are copies of reports of the ACTUAL FACTS, and show the real cost of operation and the real earnings as derived from the monthly reports of our stations.

For obvious reasons the names of the Local Companies are not given. The original reports are on file in the home office.

STATION No. 1.

From January and February, 1886 ....2 months.

CAPITAL $100,000.

Average Lamps connected, 5037-10 c. p. Average Run, 24 hours per day.

AVERAGE RECEIPTS, PER MONTH		$3,150 00
AVERAGE EXPENSES, " " :		
Coal	$356 42	
Oil and Waste	39 23	
Lamps	302 85	
Sundries	103 75	
Labor	535 00	
TOTAL AVERAGE EXPENSES, PER MONTH		$1,337 25
Average Profit		$1,812 75

ACTUAL PROFIT, 21¾ per cent. per annum.
Labor includes all salaries of every kind.

STATION No. 2.

(For the months of July, August, September, 1885, and January, February, March, 1886.)

CAPITAL $50,000.

Average Lamps connected, 2289-10 c. p. Lamps. Average Run, 17 hours per day.

AVERAGE RECEIPTS, PER MONTH		$1,065 62
AVERAGE EXPENSES, " " :		
Coal	$119 33	
Oil and Waste	32 69	
Lamps	125 62	
Sundries	146 18	
Labor	273 31	
TOTAL AVERAGE EXPENSES, PER MONTH		$697 06
Average Profit		$368 56

ACTUAL PROFIT, 8.845 per cent. per annum.

STATION No. 3.

November and December, 1885. January, February, March, 1886.

CAPITAL $31,000.

Average Lamps connected, 1655-10 c. p. Lamps. Average run, 17 hours per day.

AVERAGE RECEIPTS, PER MONTH		$592 55
AVERAGE EXPENSES " " :		
Coal	$62 18	
Oil and Waste	20 82	
Lamps	14 87	
Sundries	82 07	
Labor	167 86	
TOTAL AVERAGE EXPENSES, PER MONTH		$347 75
Average Profit		$244 80

ACTUAL PROFIT, 9.47 per cent. per annum.

STATION No. 4.

From October, 1885, to February, 1886 .... 5 months.

CAPITAL $80,000.

Average Lamps connected, 3024—10 c. p. Lamps.
Average Run, 24 hours per day

AVERAGE RECEIPTS, PER MONTH		$2,056 67
AVERAGE EXPENSES " " :		
Coal	$151 44	
Oil and Waste	59 26	
Lamps	225 15	
Sundries	335 41	
Labor	526 49	
TOTAL AVERAGE EXPENSES, PER MONTH		$1,300 78
Average Profit		$755 89

ACTUAL PROFIT, 11¼% per annum.

STATION No. 5.

From July 1885, to February 1886 .... 8 months

CAPITAL $45,000.

Average Lamps connected, 3012—10 c. p. Lamps.
Average Run, 17 hours per day.

AVERAGE RECEIPTS, PER MONTH		$825 59
AVERAGE EXPENSES:		
Coal	$26 80	
Oil and Waste	29 01	
Lamps	231 14	
Sundries	82 58	
Labor	170 00	
TOTAL AVERAGE EXPENSES, PER MONTH		$549 53
Average Profit		$276 06

ACTUAL PROFITS, 7.36% per annum.

STATION No. 6.

From July, 1885, to February, 1886 ....8 months.

CAPITAL $21,000.

Average Lamps connected, 1597—10 c. p. Lamps.

Average Run, 14 hours per day.

AVERAGE RECEIPTS, PER MONTH................................ .....$589 75

AVERAGE EXPENSES " " :

- Coal.. .... $77 56
- Oil and Waste. 10 42
- Lamps.. 49 37
- Sundries.. 144 53
- Labor... 160 00

TOTAL AVERAGE EXPENSES, PER MONTH........................ $441 68

Average Profit.. $147 87

ACTUAL PROFITS, 7.39% per annum.

STATION No. 7.

From February to July, 1886..6 months.

CAPITAL $40,000.

Average Lamps connected, 1,816-10 c. p. Lamps. Average Run, 13 Hours per day.

AVERAGE RECEIPTS, PER MONTH................................. $1,003 25

AVERAGE EXPENSES, " " :

- Coal...$ 79 48
- Oil and Waste.................................. 33 95
- Lamps 60 64
- Sundries....................................... 37 27
- Labor.................... .... 274 58

TOTAL AVERAGE EXPENSES, PER MONTH......................... $ 485 92

Average Profit....................................... $ 517 33

ACTUAL PROFITS, 15.52 per cent. per annum.

The following statements, copied from actual monthly returns of a company recently started, **clearly illustrate the growth of a new station.**

Particular attention is invited to the **gradual reduction in operating expenses,** the increase in lamps connected, and the **monthly increase in profits.**

STATION 1.—NOVEMBER, 1885.

CAPITAL, $30,000.

Lamps connected, 1,626, 10 C. P. Average hours per day, 17.

RECEIPTS		$753 35
EXPENSES:		
Coal	$275 20	
Oil and Waste	51 56	
Lamps	138 26	
Sundries	70 01	
Labor	225 40	
		760 52
1st month, loss		$7 17

DECEMBER, 1885.

Lamps connected, 1,767; 10 C. P. Average run, 18 hours per day

RECEIPTS		$828 09
EXPENSES:		
Coal	$270 21	
Oil and Waste	47 79	
Lamps	127 05	
Sundries	93 36	
Labor	229 30	
		767 74
2d month, profit		$60 35

JANUARY, 1886.

Lamps connected, 1860; 10 C. P. Average run, 17 hours per day.

RECEIPTS		$842 30
EXPENSES:		
Coal	$310 03	
Oil and Waste	41 91	
Lamps	120 35	
Sundries	51 85	
Labor	221 02	
		748 16
3d month, profit		$91 14

FEBRUARY, 1886.

Lamps connected, 1,914; 10 C. P. Average run, 16.5 hours per day.

RECEIPTS		$869 95
EXPENSES:		
Coal	$209 47	
Water	41 01	
Oil and Waste	45 03	
Lamps	118 00	
Sundries	65 05	
Labor	204 63	
		$678 19
4th month, profit		$191 76

Actual net earnings first four months 4⅜ per cent.

STATEMENT OF YEARLY EARNING CAPACITY OF A NO. 1 STATION.

Capital, $35,000. Lamps connected, 1,200—10 c. p.

Meter Basis: Rate, 1¼c. per hour for 10 c. p. lamp to private consumers.
Each lamp is estimated to give 2 hours service per day.
Station runs an average of 15 hours per day.

YEARLY EARNINGS:		
Private Consumers, 876,000 lamp hours at 1¼c.		$10,950 00
Street Lighting, 100 lamps at $20 per year each		2,000 00
		$12,950 00
YEARLY EXPENSES:		
Coal, 480 tons, at $3	$1,440 00	
Oil and Waste	125 00	
Lamp Renewals	657 00	
Water	36 00	
Repairs	360 00	
Sundries—Taxes, Insurance, &c.	300 00	
LABOR:		
Superintendent and Electrician	900 00	
Chief Engineer	900 00	
Assistant Engineer	720 00	
Fireman and General Help	600 00	
Miscellaneous Work	250 00	
		6,288 00
		$6,662 00

Percentage of Profit on $35,000 capital, 19.034%.

STATEMENT OF YEARLY EARNING CAPACITY OF A NO. 2 STATION.

Capital, $40,000. Lamps connected, 1,500—10 c. p.

Meter Basis: Rate, 1¼c. per hour.
Each lamp is estimated to be used 2 hours per day.
Station runs an average of 15 hours per day.

YEARLY EARNINGS:		
Private Customers, 1,095,000 lamp hours at 1¼c.		$13,687 50
Street Lighting, 125 lamps at $20 per year each		2,500 00
		$16,187 50
YEARLY EXPENSES:	$1,620 00	
Coal, 540 tons, at $3	150 00	
Oil and Waste	821 25	
Lamp Renewals	60 00	
Water	375 00	
Repairs	500 00	
Sundries—Taxes, Insurance, &c.		
LABOR:	900 00	
Superintendent and Electrician	900 00	
Chief Engineer	720 00	
Assistant Engineer	600 00	
Fireman and General Help	250 00	
Miscellaneous Work		6,896 25
		$9,291 25

Percentage of Profit on $40,000 capital, 23.23%.

STATEMENT OF YEARLY EARNING CAPACITY OF A NO. 3 STATION.

Capital, $50,000. Lamps connected, 2,000—10 c. p.

Meter Basis: Rate, 1¼c. per 10 c. p. lt.
Each lamp is estimated to be used only 2 hours per day.
Station runs an average of 15 hours per day.

YEARLY EARNINGS:		
Private Customers, 1,460,000 lamp hours at 1¼c.		$18,250 00
Street Lights, 150 lamps at $20 per year each		3,000 00
		$21,250 00
YEARLY EXPENSES:	$1,920 00	
Coal, 640 tons, at $3	216 00	
Oil and Waste	1,094 85	
Lamp Renewals	120 00	
Water	420 00	
Repairs	600 00	
Sundries—Taxes, Insurance, &c.		
LABOR:	1,000 00	
Secretary and Manager	900 00	
Chief Engineer	720 00	
Assistant Engineer	600 00	
Fireman and Helper	600 00	
Electrician and Meter Man	300 00	
Miscellaneous Work		8,490 85
		$12,759 15

Percentage of Profit on $50,000 capital, 25.518%.

STATEMENT OF YEARLY EARNING CAPACITY OF A NO. 4 STATION.

Lamps connected, 2,400—10 c. p.

Capital, $57,000.

Meter Basis: Rate, 1¼c. per 10 c. p. lt.
Each lamp estimated to be used 2 hours per day.
Station runs 24 hours per day.

YEARLY EARNINGS:		$21,900 00
Private Customers, 1,752,000 lamp hours at 1¼c.		3,600 00
Street Lights, 180 lamps at $20 per year		$25,500 00
YEARLY EXPENSES:	$2,880 00	
Coal, 960 tons, at $3	300 00	
Oil and Waste	1,314 00	
Lamp Renewals	180 00	
Water	480 00	
Repairs	650 00	
Sundries—Taxes, Insurance, &c.		
LABOR:	1,000 00	
Secretary and Manager	900 00	
Chief Engineer	720 00	
Assistant Engineer	720 00	
Assistant Engineer	600 00	
Firemen and Helpers	600 00	
Electrician and Meter Man	300 00	
Miscellaneous Work		10,644 00
		$14,856 00

Percentage of Profit on $57,000 capital, 26.062%.

STATEMENT OF YEARLY EARNING CAPACITY OF A NO. 5 STATION.

Lamps connected, 3,200—10 c. p.

Capital, $70,000.

Meter Basis: Rate, 1¼c. per 10 c. p.
Each lamp estimated to be used 2 hours per day.
Station runs 24 hours per day.

YEARLY EARNINGS:		$29,200 00
Private Consumers, 2,336,000 lamp hours at 1¼c.		4,000 00
Street Lamps, 200 16 c. p. at $20 each		$33,200 00
YEARLY EXPENSES:	$3,600 00	
Coal, 1,200 tons, at $3	360 00	
Oil and Waste	1,751 85	
Lamp Renewals	240 00	
Water	540 00	
Repairs	720 00	
Sundries—Taxes, Insurance, &c.		
LABOR:	1,000 00	
Secretary and Manager	900 00	
Chief Engineer	720 00	
1st Assistant Engineer	720 00	
2d Assistant Engineer	600 00	
Firemen and Helpers	325 00	
Miscellaneous Work	600 00	
Electrician and Meter Man		12,076 85
		$21,123 15

Percentage of Profit on $70,000 capital, 30.17%.

STATEMENT OF YEARLY EARNING CAPACITY OF NO. 6 STATION.

Lamps connected, 4,000—10 c. p.

Capital, $90,000.

Meter Basis: Rate, 1¼c. per 10 c. p.
Estimated average service from each lamp, 2 hours per day.
Station runs 24 hours per day.

YEARLY EARNINGS		
Customers, 2,920,000 lamp hours at 1¼c.		$36,500 00
Street Lighting, 250 lamps at $20 each		5,000 00
		$41,500 00
YEARLY EXPENSES:		
Coal, 1,500 tons, at $3	$4,500 00	
Oil and Waste	420 00	
Lamp Renewals	2,189 70	
Water	300 00	
Repairs	580 00	
Sundries—Taxes, Insurance, &c.	780 00	
LABOR:		
Secretary and Manager	1,000 00	
Chief Engineer	900 00	
1st Assistant Engineer	720 00	
2d Assistant Engineer	720 00	
Firemen and Helpers	600 00	
Electrician and Meter Man	600 00	
Miscellaneous Work	350 00	13,659 70
		$27,840 30

Percentage of Profit on $90,000 capital, 30.934%.

GENERAL MENTION

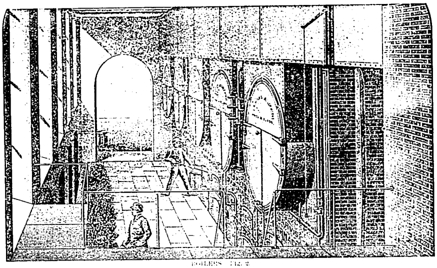
OF THE

MOST IMPORTANT APPARATUS

Required in a Central Station.

Fig. 1.

Sectional view of brick setting of horizontal tubular boiler, using Jarvis' patent furnace for burning cheap fuel.



BOILERS—FIG. 2.

Interior view of Central Station Boiler Room, having five horizontal tubular boilers, set with overhanging fronts.

THE REASONS WE SPECIFY HORIZONTAL TUBULAR BOILERS ARE:

1st. Because they can generally be obtained of a local builder, at a saving in cost of transportation over that of special patented boilers.

2d. Because the ordinary fireman fully understands how to handle and take care of the horizontal tubular boiler.

3d. Because they are easily cleaned, not liable to get out of order, and can be repaired at slight expense.

4th. Because the average of service shows, under the conditions ordinarily existing, that they are fully as economical when properly set and fired as any of the patented water tube boilers.

Fig. 3.

The NATIONAL FEED WATER HEATER for heating by exhaust steam, the feed water supplied to boilers.

Fig. 4.

The "WORTHINGTON" FEED WATER PUMP with double acting plungers.

Fig. 5.

KORTING INJECTOR, placed as a reserve appliance for feeding boilers in case of accident to pump.

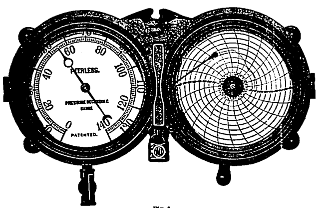


Fig. 6.

Recording Steam Gauge, to be placed in engine-room, to show daily record of changes in boiler pressure.

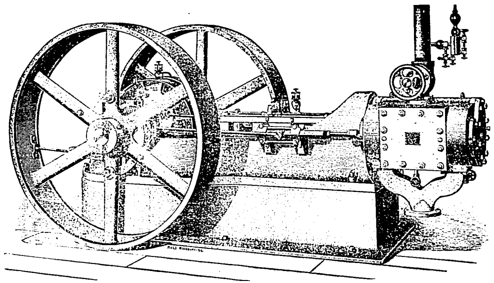


Fig. 7.

The Armington & Sims Double Diso Engine, specially designed and constructed for Central Station service.

TABLE OF SIZES OF ENGINES FOR DRIVING EDISON DYNAMOS AT A BOILER PRESSURE OF 85 LBS., WITHOUT CONDENSATION.

9½ x 10	Engine drives two No.	6 Dynamos.
10½ x 12	" " " "	8 "
12 x 12	" " " "	10 "
13 x 12	" " " "	12 "
14 x 13	" " " "	16 "
15½ x 15	" " " "	20 "

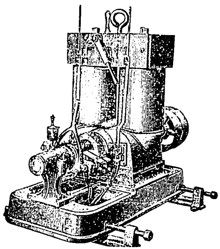


Fig. 8.

EDISON STANDARD DYNAMOS.

TABLE OF SIZES AND CAPACITIES FOR CENTRAL STATION WORK.

	10 C. P. Lamps.	16 C. P. Lamps.	Pulley. Diam.	Pulley. Face.	Pulley. Rev.	Width Belt.	Shipping Weight.	Floor Space Required by Dynamo.
Type No. 6	240	150	11¼ inches.	8	1500	7 inches.	2560	56½ x 40¾
" " 8	320	200	12 "	9	1400	8 "	3100	66¼ x 50½
" " 10	400	250	13 "	10	1300	9 "	3970	68¾ x 51½
" " 12	480	300	14 "	11	1200	10 "	4800	74 x 53¼
" " 16	640	400	17 "	13	1000	12 "	7770	84¾ x 52¾
" " 20	800	500	20 "	13	800	12 "	10,600	92 x 61

Fig. 9.

MAIN AMPERE METER to show total load on bus' line in station.

Fig. 10.

BALANCING AMPERE METER connected on neutral line of three-wire system, to show when the load is equally divided on the positive and negative sides of the system.

Fig. 11.

CENTRAL STATION STYLE OF FIELD REGULATOR FOR DYNAMOS.

825.

Fig. 12.

Pendulum Ampere Meter, used with each individual dynamo to show quantity of current developed by machine.

Fig. 14.

Breakdown Switch, connected in station "Bus' line," to be used in case of accident to change for temporary service, the three-wire system into an ordinary two-wire system.

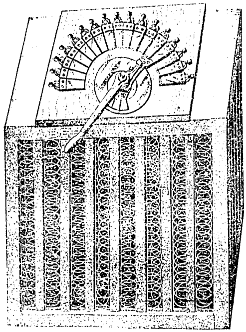


*Fig. 15.

Feeder Equalizer, a special apparatus used with every feeder, to equalize the flow of current, and to maintain an even pressure on the mains. Two are used for each feeder.

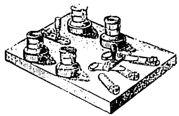


Fig. 16.

Ground Detector. One is required in every station, to test grounds on the system of conductors.

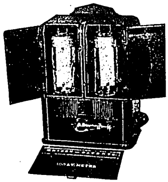


Fig. 17.

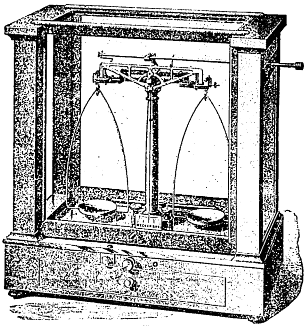


Fig. 19.

ANALYTICAL BALANCE for weighing meter plates by metric system.

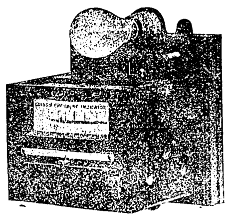


Fig. 20.

Volt Indicator. A galvanometer and resistance arranged in the form of a Wheatstone bridge, and used to indicate in the station the electro-motive force at the extreme end of each feeder. Two are used for each feeder.

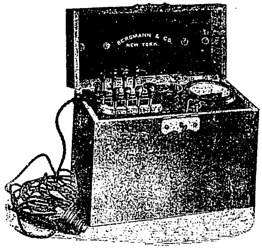


Fig. 21.

STANDARD VOLT INDICATOR. A special instrument for testing and standardizing the electrical pressure at any point throughout the entire system.

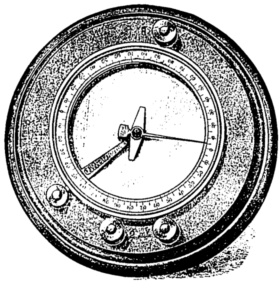


Fig. 22.

Detecting Galvanometer, to be used with battery to test individual circuits in building or elsewhere for freedom from crosses and grounds.

6213269

The Edison System of Central Station Lighting.

The Edison Electric Light Company,

Nos. 16 and 18 Broad Street,

New York City.

Laramie Letter.

Sacorro, N. M., Sept. 17, 1886.

TO THE PRESIDENT OF THE
LARAMIE ELECTRIC LIGHT CO.,
LARAMIE CITY, WYO. TER.

DEAR SIR:

Our people here are on the eve of granting a franchise to a company for the erection and maintenance of Gas Works, but are holding off for the purpose of more fully understanding the question of which is the best or most desirable light, GAS or the NEW ELECTRIC LIGHT?

An opportunity presents itself here for the investment of a few thousand dollars, which rarely offers in these parts, to a responsible party posted on this new light.

Do you know of such a party?

Yours, etc.,

A. T. HARRISON & CO.

Wholesale and Retail: General Hardware, Stoves, Queensware, Mining and Agricultural Implements.

M. N. GRANT, PRES.
W. H. HOLLIDAY, VICE-PRES.
JOHN W. DONNELLAN, TREAS.
R. M. JONES, SEC. AND MNGR.

Laramie Electric Gas Light and Fuel Company.

EDISON SYSTEM.

Laramie, Wyo., Sept. 21, 1886.

A. T. HARRISON & CO.,
SACORRO, N. M.

Your letter of the 17th at hand, asking about our electric light. We have had our plant in operation over two months and have not had one complaint from any of the consumers. It gives perfect satisfaction since starting; there have been men here from many parts of the U. S., and they say without exception that they never saw a better light and very few claim that they have seen its equal. We have all of Edison's latest improvements, so that it is even better than many other plants of the Edison Co. I consider the Edison light as much superior to gas, as gas is superior to a tallow candle.

For dwelling houses, villages and cities, or what is known as Central Station lighting, the Edison system is the only one that I consider of any use. I would not have any other system if they would put in the plant and give it to me. Some of the other systems do very well, for what is known as isolated lighting; that is, where the electric light plant is placed in a large building and the wires not run outside of the building; I think the Edison light even better for this.

We hear some objections to the Edison Company for the reason that they require all local companies to give them from 25 to 30 per cent. of the stock; this I consider one of the best features of the Edison Company. They give you the benefit of about 300 patents and of all inventions or improvements they may make or acquire by purchase without additional cost to your company. They also sell you all electrical goods

at 50 per cent. discount. They require you to render a monthly statement of your running expenses, so, if there are any abuses or mismanagement, they send a man to your station to correct them. They, being interested in the local company, it is to their interest to do everything in their power to see that the business is conducted properly. Should you organize a company, they will send you men to put in your station, and run it for you until they can teach one of your men to run it in good shape. If you let them know how many lights you wish to furnish, they will give you the cost and will contract to put in the plant at their estimate. You will make a mistake if you do not contract with them to put it in at a stated price and turn it over to you in running order. We have in Laramie a population of about five thousand people. Our station will run 1,600 lamps of 16-candle power each and we are wired for 3,200, so we can at any time increase our plant at a small expense. We now have orders ahead to wire houses to the full capacity of our station, and I think that within 18 months we shall have to put in machinery to carry what we are now wired for, or 3,200 lamps of 16-candle power. In dwelling-houses only about one-half the lamps are used at a time, so when I speak of running 1,600 lamps of 16-candle power, I mean the number we can run when they are all turned on; so we can put in about 3,000 without any increase of power. We also use the Edison meter which is very accurate; we can tell within 1½ per cent. how much light is used by each consumer; this I think is much closer than you can measure gas. I have referred your letter to the Edison Co., requesting them to give you further information. Before doing anything, I think it would pay you to come here and see our plant and light, so that you may know of the general satisfaction it gives. We will take pleasure in showing you around and in giving you all the information we can.

Very truly yours,

M. N. GRANT,

President Laramie Electric Light Co.

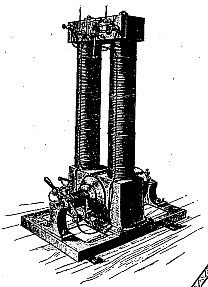
Edison Company for Isolated Lighting

This folder contains printed material issued by the Edison Company for Isolated Lighting. Organized in New York in November 1881, this company sold small generating plants for the lighting of individual buildings. It merged with the Edison Electric Light Company in 1886.

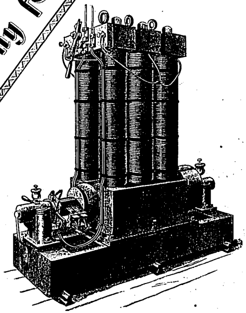
The following items have been filmed:

1. "Prices of Edison Incandescent Electric Light Apparatus . . ." (1882)
2. "The Edison Light" (1882)
3. "The Edison System of Incandescent Electric Lighting" (1883)
4. "Catalogue and Price List of Edison Light Fixtures Manufactured by Messrs. Bergmann & Co." (1883) [Bound with item #3.]
5. Annual Report (1884)
6. "List of Edison Isolated Plants Installed Prior to October 1, 1885, in the United States" (1885)

The Edison Company for Isolated Lighting.



Edison 60 Light Dynamo.



Edison 250 Light Dynamo.

PRICES

—OF—

EDISON INCANDESCENT ELECTRIC LIGHT APPARATUS

—FOR—

LIGHTING FACTORIES AND OTHER BUILDINGS.

F. O. B. NEW YORK CITY.

THE EDISON COMPANY FOR ISOLATED LIGHTING,

65 FIFTH AVENUE, NEW YORK CITY.

PRESIDENT, S. B. EATON. SECRETARY, C. GODDARD.

GENERAL MANAGER, M. F. MOORE.

NEW YORK:
C. G. BURGOYNE, PRINTER, 29 ROSE STREET.
1882.

In the following price-list the cost of the dynamo-electric machine, including regulating apparatus, extra brushes and the requisite number of lamps and sockets for "A" or "B" lights, is constant, while the cost for fixtures and wiring is only approximate. The figures given, however, are drawn from experience in installing our apparatus, which, taken altogether, is spoken of as "plant."

The only depreciation on the dynamo machine is the natural wear of the journals, commutators and brushes, which with ordinary care does not exceed one per cent. per annum. The lamps at their normal candle power are guaranteed to have an average life of not less than 600 hours, but their actual life has been found in practice to be much longer. The cost of new lamps is one dollar each. *The Edison dynamo converts into electrical energy* 95 *per cent.* of the mechanical energy or indicated horse power of the engine or other motive power, and *the Edison System of Lighting converts* 88 *per cent.* of such original mechanical energy *into light.* These results are *far in excess of those attainable by any other known method* of applying electricity to the production of light. The economy and efficiency thus attained make the *Edison System vastly cheaper* than any other now known.

We can at any time make accurate estimates of cost of installing a plant, requiring only a detailed plan of the building or buildings to be lighted. This plan should show the proposed location of the dynamo, the location and description of the machines to be lighted, also the total number of lamps required. An elevation should accompany this diagram, showing the height of ceilings. On completion of a plant we allow one of our men to remain for a reasonable period of time, at our expense, to instruct the purchaser in its use. It may be run by any workman of ordinary intelligence, and requires no more attention than could be given by any engineer without interfering with his regular duties. In our contracts abundant guarantee is given of the efficiency of the system, and we may add that *we have entirely passed the experimental stage of our enterprise,* as may be evidenced by the large number of mills, factories, hotels, &c., in various parts of the country having our system in successful operation.

Any further information may be obtained by application in writing or in person.

THE EDISON COMPANY FOR ISOLATED LIGHTING.

65 Fifth Avenue, New York, September 1, 1882.

LIST OF "E" DYNAMOS NOW IN USE.

OWNER.	LOCATION.	BUSINESS.	LAMPS.	
			"A."	"B."
Prof. Henry Draper	New York City	Laboratory	15	
Spencer, Trask & Co.	Albany, N. Y.	Bankers	15	
Eastman Dry Plate Co.	Rochester, N. Y.	Photograph Plates	15	
Prof. C. A. Young	Princeton, N. J.	College	....	30

On account of the large proportionate cost of this machine, the use of the "E" dynamo has been mainly for laboratory and experimental purposes.

FLOOR SPACE:

25 x 17½ INCHES.

PULLEY:

FACE, 3 inches.
DIAMETER, 5 INCHES.

HEIGHT:

2 FEET 11 INCHES.

REVOLUTIONS:

2,200 PER MINUTE.

WEIGHT:

700 POUNDS.

4 HORSE POWER.

THE EDISON "E" DYNAMO

FOR

15 A LIGHTS (16 CANDLE POWER), OR 30 B LIGHTS (8 CANDLE POWER).

ITEMS.	15 A LIGHTS.		30 B LIGHTS.
One "E" dynamo-electric machine complete, regulating resistance, half dozen brushes, with lamps and sockets..................	$500 00		$530 00
Fixtures vary in price from 75 cents to $5.85 per lamp, according to style and finish. For common factory use the cost would probably not exceed 75 cents per lamp..........................	11 25		22 50
The cost of wire for conductors, cut-outs, safety-catches, and other accessories will vary with distance of lamps from dynamo, also with number of branches and disposition and grouping of lamps. The probable average will be..............................	50 00		90 00
	$561 25		$642 50

These prices are exclusive of counter-shaft, belt connections, and foundations.

LIST OF "Z" DYNAMOS NOW IN USE.

OWNER.	LOCATION.	BUSINESS.	LAMPS. "A."	LAMPS. "B."
James Harrison	Newburgh, N. Y.	Woolen Mill		126
James Taylor	Newburgh, N. Y.	Woolen Mill		125
Record Room	Washington, D. C.	Government Printing	125	
Rand, McNally & Co.	Chicago, Ill	Printing		120
Baldwin Locomotive Works	Philadelphia, Pa.	Locomotives	75	
F. C. Durant	Blue Mountain Lake, N. Y.	Summer Hotel	125	
J. B. Stetson & Co.	Fourth and Montgomery Streets, Phila.	Hat Manufacturers	120	
Marshall Field & Co.	Chicago, Ill.	Dry Goods	60	
J. Pierpont Morgan	36th street and Madison avenue, N. Y.	Residence	250	50
J. Hood Wright	Fort Washington, N. Y.	Residence		240
National Tube Works	McKeesport, Pa.	Pipes and Tubes	65	
Winona Mill Co.	Winona, Minn.	Flour Mill	70	
James Gordon Bennett	Yacht Namouna	Steam Yacht		120
S. H. Everett	84 Chatham street, N. Y.	Hotel	130	
U. S. Rolling Stock Co.	Urbana, Ohio	Car Shops		128
Nathan & Dreyfus	106th street and East River, N. Y.	Oil Cups and Injectors		125
Alfred Dolge	Little Falls, N. Y.	Piano Sounding Boards		126
Tingue, House & Co	Glenville, Conn.	Cloth Mill		130
Palmer House	Chicago, Ill.	Hotel	60	
R. H. Coleman	Cornwall, Pa.	Iron Smelter	60	
U. S. Rolling Stock Co.	Chicago, Ill.	Car Shops		126
Oregon Railway & Navigation Co	S. S. Columbia	Steamship	120	
Fall River Bleachery	Fall River, Mass.	Bleachery	45	40
Merrimac Mfg. Co.	Lowell, Mass.	Print Works		250
Ladd & Logan	San Francisco, Cal.	Agency	60	
Matthiessen & Weichers	Jersey City, N. J.	Sugar Refinery		300
Boston Sugar Refinery	East Boston, Mass.	Sugar Refinery		125
Rittenhouse Mfg. Co.	Passaic, N. J.	Silk Mill	65	
Arlington Mills	Lawrence, Mass.	Woolen Mill	130	
Trenton Iron Co.	Trenton, N. J.	Wire Works	75	
John V. Farwell	Chicago, Ill.	Dry Goods	130	
McCormick Harvesting Mach. Co.	Chicago, Ill.	Agricultural Machines	60	
Carr & Hobson	Bergen Point, N. J.	Agricultural Tools		120
William Strange	Paterson, N. J.	Silk Mill	65	
Cooke Locomotive & Machine Works	Paterson, N. J.	Locomotives	60	
Sperry & Barnes	New Britain, Ct.	Pork Packers		240
E. S. Jaffray & Co.	Broadway and Leonard street, N. Y.	Dry Goods	100	80
D. F. Beatty	Washington, N. J.	Organs and Pianos		250
American Bank Note Co.	Liberty street and Broadway, N. Y.	Bank Note Printing		125
Oregon Railway & Navigation Co.	Portland Docks, Oregon	Docks	480	
Manhattan Railway Co.	98th street and Third avenue, N. Y.	Railroad Shops		125
Oregon Railway & Navigation Co.	Queen of Pacific	Steamship		250
Merrick Thread Co.	Holyoke, Mass	Thread		98
Max Ams	372 Greenwich street, N. Y.	Preserves	65	
Hotel Vendome	Boston, Mass.	Hotel	63	
Worumbo Mfg. Co.	Lisbon Falls, Me.	Woolen Mills		180
Fairbanks & Co.	St. Johnsbury, Vt.	Scales	60	
Weed, Parsons & Co	Albany, N. Y.	Printers		150
Germania Mills	Holyoke, Mass	Woolen Mill	50	20
Steamer Carolina	Bay Line	Steamer		126
University State of Missouri	Columbia, Mo.	University	60	
Boston Herald	Boston, Mass.	Newspaper	150	
Mill Creek Distilling Co.	Cincinnati, Ohio	Distillers	60	
Willimantic Linen Co.	Willimantic, Ct.	Linen Thread	60	
Whitney Paper Co.	Holyoke, Mass	Paper		120
Sayles & Washburn	Mechanicsville, Ct.	Woolen Mills		132
Boston Rubber Shoe Co.	Boston, Mass.	Rubber Shoes	60	
Hinds, Ketcham & Co.	N. Y. City	Printers		240
N. Y. & Norwich Line	"City of Worcester."	Steamboat		325
McKee & Fuller	Catasauqua, Pa	Car Shops		120
Seymour, Sabin & Co	Stillwater, Minn	Agricultural and Car		250
Pemberton Co.	Lawrence, Mass	Woolens		125
Aitken, Son & Co.	18th street and Broadway, N. Y.	Fancy Goods	50	70
Borden Block	Fall River, Mass.	Stores, Offices, &c.	125	12
Brooklyn Sugar Refinery	Brooklyn	Sugar Refinery	70	10
Pottstown Iron Co.	Pottstown, Pa.	Iron Foundry	60	
J. P. Squire	East Cambridge, Mass.	Pork Packers	130	
Clark Thread Co.	Newark, N. J.	Threads		125
Calumet Club	Chicago	Club	64	
N. K. Fairbanks	Chicago	Residence	65	
Gazette Publishing Co.	Davenport, Ia.	Newspaper	120	

The first "Z" dynamo was installed September 28th, 1881, in the mill of Mr. James Harrison, Newburgh, N. Y.

FLOOR SPACE:

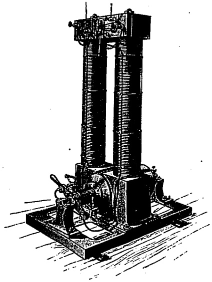
45 x 39 inches.

HEIGHT:

6 feet.

WEIGHT:

3,000 pounds.



PULLEY:

Face, 6 inches.
Diameter, 10 inches.

REVOLUTIONS:

1,200 per minute.

10 HORSE POWER.

THE EDISON "Z" DYNAMO

FOR

60 A LIGHTS (16 candle power), or 120 B LIGHTS (8 candle power).

ITEMS.	60 A Lights.		120 B Lights.
One "Z" dynamo-electric machine complete, regulating resistance, half dozen brushes, with lamps and sockets	$1,200 00		$1,320 00
Fixtures vary in price from 75 cents to $5.85 per lamp, according to style and finish. For common factory use the cost would not exceed 75 cents per lamp	45 00		90 00
The cost of wire for conductors, cut-outs, safety-catches, and other accessories for above plants will vary with distance of lamps from dynamo, also with number of branches and disposition and grouping of the lamps. The probable average will be	350 00		450 00
	$1,595 00		$1,860 00

These prices are exclusive of counter-shaft, belt connections, and foundations.

LIST OF "L" DYNAMOS NOW IN USE.

OWNER.	LOCATION.	BUSINESS.	LAMPS. "A."	LAMPS. "B."
Pemberton Mill Co.	Lawrence, Mass.	Cotton Mill	250	
Worumbo Mfg. Co.	Lisbon Falls, Me.	Woolen Mill	150	
W. M. Singerly	Phila. Record	Newspaper	200	50
Harder Knitting Co.	Hudson, N. Y.	Knit Goods	160	
A. E. Martin	Anamosa, Iowa	Penitentiary		250
S. H. Everett	98 Barclay St., N. Y.	Hotel	250	
Academy of Music	Chicago, Ill.	Theatre	150	
Lorraine Woolen Mill	Pawtucket, R. I.	Woolen Mill	150	
Laurel Lake Mill	Fall River, Mass.	Cotton Mill	150	
Slater Cotton Co.	Pawtucket, R. I.	Cotton Mill	300	

The first "L" dynamo was shipped from our shops August 4th, 1882.

FLOOR SPACE:

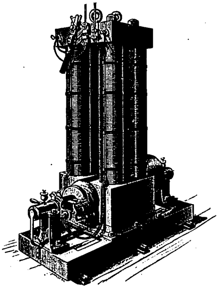
60 x 39 INCHES.

HEIGHT:

6 FEET 6 INCHES.

WEIGHT:

6,000 POUNDS.



PULLEY:

FACE, 9 INCHES.
DIAMETER, 14 INCHES.

REVOLUTIONS:

900 PER MINUTE.

19 HORSE POWER.

THE EDISON "L" DYNAMO

FOR

150 A LIGHTS (16 CANDLE POWER), OR 300 B LIGHTS (8 CANDLE POWER).

ITEMS.	150 A Lights.		300 B Lights.
One "L" dynamo-electric machine complete, regulating resistance, half dozen brushes, with lamps and sockets	$2,000 00		$2,300 00
Fixtures vary in price from 75 cents to $5.85 per lamp, according to style and finish. For common factory use the cost would probably not exceed 75 cents per lamp...	112 50		225 00
The cost of wire for conductors, cut-outs, safety-catches, and other accessories for above plants will vary with distance of lamps from dynamo, also with number of branches and disposition and grouping of the lamps. The probable average will be...	525 00		900 00
	$2,637 50		$3,425 00

These prices are exclusive of counter-shaft, belt connections, and foundations.

LIST OF "K" DYNAMOS NOW IN USE.

OWNER.	LOCATION.	BUSINESS.	LAMPS. "A."	LAMPS. "B."
J. Pierpont Morgan	36th St. and Madison Ave., N. Y.	Residence	250	50
Wamsutta Mills	New Bedford, Mass.	Cotton Mills	750	
G. W. Childs	Public Ledger	Newspaper	250	
King Philip Mills	Fall River, Mass.	Cotton Mills	750	
New England Pin Co.	Winsted, Conn.	Silk Mill	250	
Lockwood Co.	Waterville, Me.	Cotton Mill	250	
Peacedale Mfg. Co.	Peacedale, R. I.	Cotton Mill	250	
Bourne Mill	Fall River, Mass.	Cotton Mill	500	40
Conanicut Mills	Fall River, Mass.	Cotton Mill	250	
Laurel Lake Mills	Fall River, Mass.	Cotton Mill	250	
H. J. Rogers	Appleton, Wis.	Flour Mill	300	
Sibley Mfg. Co.	Augusta, Ga.	Cotton Mill	500	
H. K. & F. B. Thurber & Co.	New York City	Wholesale Grocers	250	80
James Gordon Bennett	"Herald," New York	Newspaper	500	
Lorraine Woolen Mills	Pawtucket, R. I.	Worsted Mill	250	
Western Edison Light Co.	Chicago, Ills.	Agency	250	
J. W. Doane	Chicago, Ills.	Residence	250	
Marshall Field	Chicago, Ills.	Residence		
Edson Keith	Chicago, Ills.	Residence		
O. R. Keith	Chicago, Ills.	Residence		

The first "K" dynamo was shipped from our shops June 3d, 1882.

FLOOR SPACE:

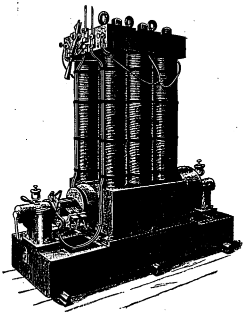
70 X 39 INCHES.

HEIGHT:

6 FEET 6 INCHES.

WEIGHT:

8,250 POUNDS.



PULLEY:

FACE, 9 INCHES.
DIAMETER, 14 INCHES.

REVOLUTIONS:

900 PER MINUTE.

35 HORSE POWER.

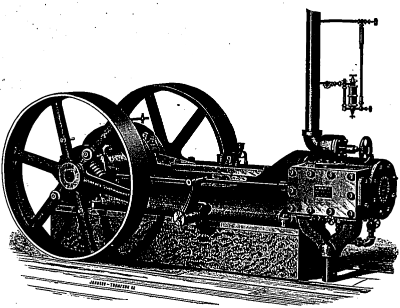
THE EDISON "K" DYNAMO

FOR

250 A LIGHTS (16 CANDLE POWER), OR 500 B LIGHTS (8 CANDLE POWER).

ITEMS.	250 A LIGHTS.		500 B LIGHTS.
One "K" dynamo-electric machine complete, regulating resistance, half dozen brushes, with lamps and sockets.....	$3,000 00		$3,500 00
Fixtures vary in price from 75 cents to $5.85 per lamp, according to style and finish. For common factory use the cost would not exceed 75 cents per lamp........	187 50		375 00
The cost of wire for conductors, cut-outs, safety-catches, and other accessories for above plants will vary with distance of lamps from dynamo, also with number of branches and disposition and grouping of the lamps. From experience in plants installed we find the probable average will be...........................	875 00		1,500 00
	$4,062 50		$5,375 00

These prices are exclusive of counter-shaft, belt connections, and foundations.



ENGINES.

When the power already present cannot be conveniently applied to running the dynamo machine, we can supply engines especially designed for the Edison Light. A cut of one of such engines is given above, and the various sizes, prices, &c., of same are given below.

M. E. P. Cutting off. ¼ Stroke.	CLASS.	A.	B.	C.	D.	E.
	CYLINDER.	6½ x 8	8½ x 10	9½ x 12		13 x 13
	FLOOR SPACE* IN INCHES.	39 x 84	46 x 90	56 x 100		62 x 124
	PRICES.	$650	$850	$1200		$2000
	REV.	H. P.	H. P.	H. P.	H. P.	H. P.
20	300 350	8.04 9.4	17.18 20.05	25.74 30.	The size for this class engine has not been fully determined.	52.2 60.96
30	300 350	12.09 14.1	25.77 30.07	38.61 45.		78.3 91.44
40	300 350	16.12 18.8	34.36 40.1	51.48 60.		104.4 121.9
50	300 350	20.15 23.5	42.95 50.12	64.35 75.		130.5 152.4
60	300 350	24.17 28.2	51.54 60.14	77.22 90.		156.6 182.8
70	300 350	27.2 32.9	60.14 70.17	90.09 105.		182.7 213.3
80	300 350	32.23 37.6	68.72 80.19	102.9 120.		208.8 243.8

The prices of these engines include automatic oilers for cylinder, crank-pin, cross-head, and bearings.

*These measurements include space required for projection of cylinder and pulleys.

The Edison Light.

THE EDISON COMPANY

FOR

ISOLATED LIGHTING,

65 FIFTH AVENUE, NEW YORK CITY.

PRESIDENT, S. B. EATON.

SECRETARY, C. GODDARD.

GENERAL MANAGER, M. F. MOORE.

NEW YORK.
C. G. BURGOYNE, PRINTER, 29 ROSE STREET.
1882.

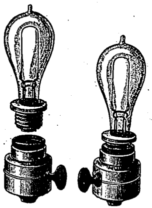
THE EDISON

Incandescent Electric Light.

ARC AND INCANDESCENT LAMPS COMPARED.

There are two systems of electric lighting, namely, the Arc and the Incandescent. The arc is a light of great intensity, concentrated in one small spot, constantly changing in color, and very trying to the eyes. It is now used in streets and public buildings. The incandescent is a small, soft, steady light, of the brightness of an ordinary gas jet of the best quality, and is especially adapted for domestic and industrial purposes. These two systems of lighting are radically distinct, a fact which must

be borne in mind when comparing the Edison incandescent system with the arc lights.



The Edison Incandescent Lamp.

This lamp consists of a pear-shaped glass globe about 4½ inches in height, exhausted of air, into which is sealed a filament of carbonized bamboo slightly thicker than a horse-hair. This

filament, becoming incandescent by the passage of the current of electricity through it, emits a beautiful, soft, white light, absolutely steady and constant, and equalling in intensity, or exceeding if desired, the illuminating power of a gas jet of the best quality.

The lamp is screwed into a socket which is permanently attached to a gas or other chandelier or bracket, and contains a key whereby the light in the lamp may be turned on or off. The lamp, once screwed into the socket, needs no further attention or care until the carbon breaks, when the old lamp is unscrewed from the socket and a new one screwed in, the work of a few seconds. The lamps vary in the number of hours which they will burn, but their average life, at 16 candle power, exceeds 600 hours of actual burning. Each light is entirely independent of the others, and may be arranged and controlled singly, in pairs, or in groups of any desired number, and may be placed in any position whatever, inverted or otherwise.

Absence of Heat.

The Edison lamp gives out but little heat (less than one-fifteenth as much as gas), may be grasped by the naked hand without inconvenience, is absolutely free from odor and poisonous or noxious gases, and neither heats nor vitiates the surrounding atmosphere. The most delicate of fabrics are not scorched or injured by being wrapped around the lamp when burning at its normal intensity.

Non-Explosive.

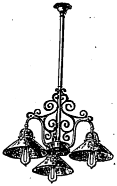
The lamp does not explode, and even if the glass is broken by any accident, the carbon is instantly consumed and the light at once goes out harmlessly.

Peculiar Adaptability.

Besides being unequalled for domestic and general illumination, the light is especially adapted to the workshop. For the desk and workbench it is superior to any other artificial light, inasmuch as by inverting the lamp, its whole light may be thrown on the work in hand, in any required position whatever.

Not Injurious to Eye-sight.

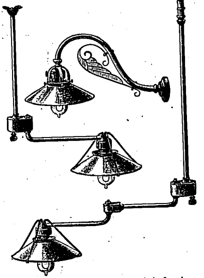
The light, although bright and clear, is not injurious to the eyes, even if used close to them. Indeed it is found in practice that weak eyes, previously injured by gas, may use the light with impunity.



Fixtures.

The fixtures used for this lamp are of the same general character as those used for gas, including swing brackets, drop lights, portable

lights, together with devices for inverting the light or burning it in any position, perpendicular

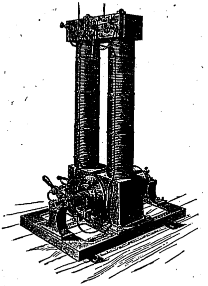


or otherwise, and also for burning it in fire damp and under water.

THE DYNAMO.

The Edison dynamo supplies the current for the lamp. It consists of a powerful electro magnet, between the poles of which an armature or inducing coil revolves. The motive power may be either steam or a constant water power. The dynamo shown in the drawing below requires nine horse power, and generates a current either for 60 lights of 16 candle power each, or for 120 lights of 8 candle power each. It needs only a few minutes attention each day for oiling, &c., and does not get out of order. A special engineer or electrician is not necessary. Accompanying each dynamo is a regulator by which the intensity of the lights may be regulated at will.

Besides this dynamo there are other dynamos of larger sizes, requiring more horse-power and generating currents for a still larger number of lamps, while the mammoth dynamo, known as the Edison central station dynamo, generates a current sufficient for 1,200 Edison lamps of 16 candle power each, or 2,400 lamps of 8 candle power each.



THE EDISON DYNAMO.

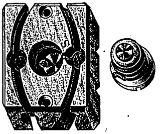
SAFETY.

There is no danger to life, health, or person, in the current generated by any of the Edison dynamos. The electric current is so feeble that the wires at any part of the system, and even the poles of the generator itself, may be grasped by the naked hand without the slightest effect; in fact, the current is scarcely perceptible to the touch.

FIRES IMPOSSIBLE.

Besides the safety from injury to the person, another prominent feature of the Edison system is its freedom from danger of fire. This is secured by means of a small automatic device invented by Mr. Edison, called the "Cut-out" (or "Safety-catch"), which may be compared to an overflow pipe in a water system, or to a safety valve on a steam boiler. This safety-catch consists of a small piece of wire fusible at a low temperature, which is placed in every circuit and even in the lamp itself. If, therefore, the wires should become heated from any cause, this safety-catch would at once melt off and open the circuit, thus averting all possible danger from

fire. The circuit can be again closed by taking out the safety plug and putting in a new one, the work of a moment. Fires from elec-



Edison "Cut-out."

tric light arise from one of three causes; first, a crossing of wires, that is to say, wires coming in contact with each other; second, the jumping of the current from one wire to the other; third, the overloading of wires with a greater amount of current than they are calculated to bear, and thereby melting them. Under the Edison system fires are impossible from any of these three sources. Not only are

the wires thoroughly insulated, and also, when necessary, protected by mouldings, but the "cut-out" is so introduced in the wires that fire from any of the three sources above named, or from any source whatever, is absolutely impossible. The lamp is now in use in a large number of factories and dwellings, yet no fire has ever taken place in the Edison system.

Steamboat Lighting.

The light, besides being available for dwellings and factories, is also especially adapted to the lighting of steamboats. The cleanliness, absence of disagreeable odor, ventilation, freedom from danger by fire (no matches being required), and economy, make the light better for steamboats than any other known illuminant. The lamp has also been found of the greatest value for the examination of a ship's propeller, rudder or hull, under water.

Lighting of Mines.

The lamp is also used for lighting mines. Mr. Edison has invented devices for protecting

the lamp from breakage, even from the roughest handling, and for making the light absolutely safe from explosion or fire, even if breakage should take place in fire damp.

Transmission of Power.

The Edison system supplies power as well as light. By the use of the dynamo, power may be transferred from a source of power to distant points for use, or from one portion of a factory to another. This invention affords not only the cheapest method, in many cases, of transferring power, but also facilities for minute subdivision and complete control. Among the many uses made of the electric power are the following: The running of lathes, printing presses, sewing machines, other small machines, elevators, and pumping water. The current can also be applied for telephones, call bells and burglar alarms.

Lighting of Cities.

The Edison system for lighting large cities is modeled on the existing gas system. The cur-

rent is generated at a central point, is distributed through subterranean conductors laid under the streets, connections are made with houses by means of branch conductors, and the current thus diverted, after passing through a meter in the cellar, which registers with perfect accuracy the quantity consumed, is then distributed over the house for use either for light or power. Houses are so wired that not only is light supplied, but by means of a device known as an electric motor power is also furnished for both industrial and domestic purposes.

Economy.

The economy of the Edison incandescent light, as compared with gas, is beyond question, no matter whether the gas is obtained through the ordinary distribution system, as in cities, or is manufactured on the premises of the consumer by a portable gas machine. In estimating on this subject, the intensity of light is an important element to be considered, as the illuminating power of gas in different localities varies. The average 5 foot gas burner does not, even in best gas companies, give a light of over 12 can-

dle power, so, in order to obtain the same amount of light as that given by the Edison standard lamp (16 candle power), a 7 foot gas burner must be used. Even then, the whole light of the gas burner cannot be utilized on a work bench or desk, because it can neither be inverted nor entirely backed up by a shade, while, on the other hand, the whole 16 candle power of the Edison lamp is effective, inasmuch as it may be inverted, or otherwise directed to any desired spot.

Cost per Hour.

Assuming that the desired horse power is already present, the hourly cost of running 60 Edison lamps of 16 candle power each is as follows:

9 horse power (3 pounds of coal per hour per horse power at $5 per ton)	.0603
Depreciation on Machine at 10%	.0346
" " Lamps	.10
" " Brushes	.02
Interest on investment at 6%	.0850
Total running expenses per hour	30 cents.

The cost of the same number of gas jets for the same time, would be as follows:

60 gas jets each burning 7 feet of gas per hour, or a total of 420 feet at $2 per 1000..... .84½ cents.

This shows a saving, by the use of the Edison light, of 54 cents per hour of actual burning, the cost of gas being nearly three times as much as the Edison light.

General Advantages.

Add to this pecuniary economy the healthfulness of the light as compared with that of gas, its freedom from odor and from danger by fire, its steadiness, adaptability, completeness, and beauty, and there can be no doubt that the Edison light is unsurpassed by any other method of artificial lighting whatever.

Prices Furnished.

The price for dynamos, lamps, and a complete outfit, together with estimates for wiring, will be furnished upon application to the company.

The Highest Prize at Paris.

The highest possible award obtainable at the recent Electrical Exposition at Paris was a Diploma of Honor, which was higher than a gold medal. The juries awarded Edison three Diplomas of Honor and two gold medals. The full Congress affirmed this award, and gave to Edison exclusively a Diploma of Honor for an incandescent light.

Testimonials.

The following testimonials have been received from a few of the places where the light is now in successful operation.

TESTIMONIALS.

ORANGE CO. WOOLEN MILLS,

Newburgh, N. Y., Feb. 11, 1882.

The Edison Company for Isolated Lighting:

Gentlemen—I believe my mill was the first building outside of your own works that you lighted with your electric light, and therefore it may be called No. 1. Besides being *job* No. 1, it is a *No.* 1 job, and a *No.* 1 light, being better and cheaper than gas and absolutely safe as to fire. I expect the difference in insurance rates will pay the whole expense inside of two years, and after that is done, said difference will pay the *entire* expense of lighting my premises and leave me a handsome amt. annually besides.

JAMES HARRISON.

WINONA MILL COMPANY,

Manufacturers of Choice Flours.

Winona, Minn., Feb. 16th, 1882.

To Edison Company for Isolated Lighting, New York:

Gentlemen—Yours of the 10th at hand and noted. We are pleased with the Edison light. It is a very pleasant, steady light, and fully answers our purpose, for we regard it as perfectly safe, much more so than gas or closed lanterns, for it is simply impossible to fire a building or cause one of the (much to be dreaded) explosions that flouring mills are liable to when lights are carelessly used. We have used it constantly since December last, and it more than meets our requirements. You are at liberty to refer any inquiring friend to Yours truly,

WINONA MILL CO.

[NOT FILMED: PAGES 18-26. THESE
TESTIMONIALS ALSO APPEAR IN THE
EDISON ELECTRIC LIGHT CO. BULLETINS.]

EDISON PIONEERS
ROOM 1102
40 WEST 40TH STREET
NEW YORK CITY

The Edison Light

EDISON PIONEERS
ROOM 1102
40 WEST 40TH STREET
NEW YORK CITY

EDISON PIONEERS
ROOM 1102
40 WEST 40TH STREET
NEW YORK CITY

H. V. Parsell Jr.

THE EDISON SYSTEM

OF

INCANDESCENT ELECTRIC LIGHTING,

AS APPLIED IN

MILLS, STEAMSHIPS, HOTELS, THEATRES, RESIDENCES, &C.,

BY

THE EDISON COMPANY FOR ISOLATED LIGHTING,

65 FIFTH AVENUE, NEW YORK CITY.

1883.

CONTENTS.

THE EDISON SYSTEM OF INCANDESCENT ELECTRIC LIGHTING.

This pamphlet is issued by the Edison Company for Isolated Lighting, for the information of manufacturers, hotel keepers, steamship owners, theatrical managers and other users of artificial light. It contains a brief description of the Edison system of lighting mills, hotels, steamships, theatres, &c., by means of isolated plants, that is to say, by apparatus which is owned, and controlled by the *purchaser;* also such information as to the detail of engines, dynamos, wiring, fixtures, &c., as will enable any person to estimate approximately in regard to the cost and running expenses of a plant of a given capacity.

The Edison Company for Isolated Lighting was organized in November, 1881, and, as a licensee of the Edison Electric Light Company, is entitled to do business under the Edison patents for electric lighting. Of these patents, 216 have been already issued in the United States, including the patents securing to the Edison Company *the fundamental principles of incandescent lighting*, and there are applications for 164 additional patents still pending in the Patent Office, which number is being constantly increased by Mr. Edison's further inventions. These inventions form the *complete system* of Edison's incandescent lighting now successfully introduced into public use.

Since its organization, and up to this date, this Company has installed in mills, factories, hotels, steamships, stores, residences, &c., in the United States, 199 isolated plants, aggregating upwards of 44,786 lamps.

There have also been installed by other Edison companies in England, on the Continent of Europe, and in various parts of the world, upwards of 158 plants, amounting to about 26,929 lamps, thus making the total number of Edison isolated plants in all parts of the world now amount to 357, with an aggregate of 71,715 lamps.

These facts, although briefly stated, cannot fail to present to the mind of a business man the progress which has been made by this, an entirely new enterprise; but when we also state that

1. We have never had a plant rejected;
2. No fire or accident of any kind has ever occurred from the use of an Edison plant; and
3. Many of our plants have been largely increased (see page 16),

it is at once apparent that there are such substantial merits in the Edison system as merit the consideration of those who use artificial light.

DESCRIPTION.

There are two systems of electric lighting, namely, the Arc and the Incandescent. The arc is a light of great intensity, concentrated in one small spot, constantly changing in color, and very trying to the eyes. It is commonly used in illuminating streets and large open spaces. The incandescent is a soft light, of the brightness of a good gas jet of the best quality, but without flicker, and is especially adapted for domestic and industrial purposes. These two systems of lighting are radically distinct, a fact which must be borne in

mind when comparing the Edison incandescent system with the arc lights.

THE EDISON INCANDESCENT LAMP.

This lamp consists of a pear-shaped glass globe about 4½ inches in length, exhausted of air, into which is sealed a filament of carbonized bamboo slightly thicker than a horse-hair. This filament, becoming incandescent by the passage of the current of electricity through it, emits a beautiful, soft, white light, absolutely steady and constant, and equalling in intensity, or exceeding, if desired, the illuminating power of a gas jet of the best quality.

The lamp is screwed into a socket which is permanently attached to a gas or other chandelier or fixture, and contains a key whereby the light in the lamp may be turned on or off. The lamp, once screwed into the socket, needs no further attention or care until the carbon breaks, when the lamp is unscrewed from the socket, and a new one screwed in its place—the work of a few seconds. The lamps vary in the number of hours which they will burn, but their average life, at normal candle power, exceeds 600 hours of actual burning. In practice, the lamps have an average life of much longer duration. The company, however, gives a *written guarantee* to every purchaser of a plant that the average life of the lamp shall be at least 600 hours of burning at the candle power for which the lamp is rated.

Each lamp is entirely independent of the others, and may be arranged and controlled singly, in pairs, or in groups of any desired number, and may be placed in any position whatever, inverted or otherwise.

The lamps are made in various sizes, to give the light of 10, 16, 32, 50, and 100 candles respectively. All these lamps may be burned upon the same circuit, that is to say, a plant may have all its lamps of the same candle power, or they may be varied at any time, up to the equivalent light-producing capacity of the dynamo, without changing either the wiring, fixtures or dynamo. For instance, a 16 candle lamp may be unscrewed from the socket and a 100 candle lamp put in its place, and so on, each lamp being interchangeable with any of the others throughout. The 16 candle lamp is, however, found to be the one which fills all ordinary requirements, but there are numerous cases where 10 candle lamps are found ample, especially where each workman requires a separate light immediately over his work.

The Edison lamp gives out but little heat (less than one-fifteenth as much as gas), may be grasped by the naked hand without inconvenience, is absolutely free from odor and poisonous or noxious gases, and neither heats nor vitiates the surrounding atmosphere. The most delicate of fabrics are not scorched or injured by being wrapped around the lamp when burning at its normal intensity.

NON-EXPLOSIVE.

The lamp does not explode, and even if the glass is broken by any accident, the carbon is instantly consumed and the light at once goes out harmlessly.

PECULIAR ADAPTABILITY.

Besides being unequalled for domestic and general illumination, the light is especially adapted to the workshop, inasmuch as by inverting the lamp, its whole light may be thrown on the work in hand, in any required position whatever. Attached to a flexible cord, the light may be placed under, over or inside of machines of every description, put under water, used in the midst of delicate or dangerous substances—and, in fact, applied as no other system of artificial lighting can possibly be.

NOT INJURIOUS TO EYESIGHT.

The light, although bright and clear, is not injurious to the eyes, even if used close to them.

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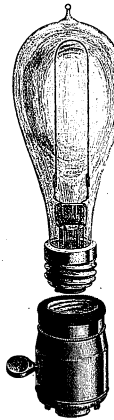
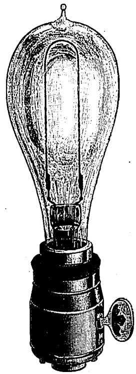


The Edison Incandescent Lamp
Detached from Socket.



The Edison Incandescent Lamp
Screwed in Socket.

FIXTURES.

The fixtures used for this lamp are of the same general character as those used for gas. A great variety of fixtures and attachments for the Edison light are manufactured by Messrs. Bergmann & Co., 292 Avenue B, New York, whose catalogue will be found at the end of this book. Special designs to suit peculiarities of decoration and finish of rooms can be made to order if desired.

THE DYNAMO.

The Edison dynamo supplying the current for the lamps consists of a powerful electro-magnet, between the poles of which an armature or inducing coil revolves. The motive power may be either steam or water.

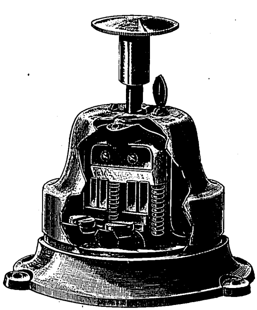
It is not necessary to have a special engineer or electrician to run this dynamo. On completion of a plant we allow one of our men to remain for a reasonable period of time, at our expense, to instruct the purchaser in its use. It may be run by any workman of ordinary intelligence, and requires no more attention than could be given by any engineer without interfering with his regular duties.

Accompanying each dynamo is a regulator by which the intensity of the lights may be regulated at will.

SAFETY.

The current generated by the Edison dynamos never exceeds a certain intensity, or pressure, namely, the pressure exerted by the current in overcoming the resistance offered by the filament of carbon in the lamp, the unit of such pressure being termed a "volt." The highest intensity reached by the current generated by our dynamos does not exceed 110 volts, no matter what the lamp capacity of the machine may be. This may seem a paradoxical statement to those unacquainted with electrical science, but inasmuch as the use of electric lights is becoming universal, a few words in explanation may not be out of place.

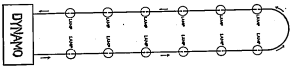
Let us compare the arc light with the Edison incandescent light. In the former, there are two pencils of carbon, the points of which are opposite each other, but separated by a space of about quarter of



THE EDISON SWITCH
FOR TURNING GROUPS OF LIGHTS ON OR OFF.

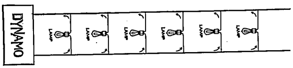
an inch, the light being produced by the jumping of the current from one pencil to the other, thus forming what is called a "voltaic arc." This jumping is effected by means of the pressure of the current, and, inasmuch as all arc lamps are placed in the path of one

conductor, or, as it is termed, in "series," it follows that when there are a large number of lamps in circuit the pressure of the current must necessarily be very great to drive it through all the lamps and then back to the dynamo. The following diagram will illustrate the manner of putting lamps in series:



It will, therefore, be seen, that in order to get to the second lamp the current must pass through the first, and so on, the electromotive force being multiplied by the number of lamps in circuit. Thus, if a current of 50 volts pressure is needed to operate one arc light, it would necessitate an additional 50 volts for each additional lamp, so that with 40 arc lights in circuit, a current of 2,000 volts pressure would be required.

In the Edison system, however, the lamps are placed in "multiple arc," that is to say, both the outgoing and incoming wires are tapped and the lamp placed between, as shown in the following sketch:



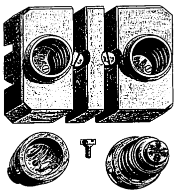
It is obvious, therefore, from this sketch, that in our system it is not necessary for the current to pass through the first lamp in order to get to the second one, because each lamp offers to the current a path by which to cross over and re-enter the machine. It is also seen that all the lamps require only the same degree of electrical pressure to bring them up to incandescence, and, therefore, the pressure of the current is *not* multiplied according to the number of lamps. All the conductors are kept charged by the dynamo, with a certain quantity of electricity, but its intensity or pressure never varies.

The effect which a current of electricity produces when applied to various substances, differs according to the resistance offered by such substances. The resistance offered by the carbon in the Edison lamp is 140 units, or "ohms," to overcome which, for the purpose of producing an ordinary light, is required a pressure of about 110 volts. The human body has a resistance of about 20,000 ohms which could be overcome only by a current of very much higher pressure, consequently there is no danger to life, health or person, in the current generated by any of the Edison dynamos. The current is of such low pressure that the conductors at any part of the system, and even the poles of the dynamos themselves, may be grasped by the naked hand without the slightest effect; in fact, the current is scarcely perceptible to the touch.

FIRES IMPOSSIBLE.

Besides the safety from injury to the person, another prominent feature of the system is its freedom from danger of fire. This is secured by means of a small automatic device invented by Mr. Edison, called the "Cut-out" or "Safety-catch," which may be compared to an overflow-pipe in a water system, or a safety valve on a steam boiler. This safety-catch consists of a small piece of lead wire fusible at a low temperature, placed in each branch circuit. As was stated above, the lamp offers a resistance proportioned to the pressure of the current generated. It will readily be understood, therefore, that if a conductor of less resistance be interposed across the circuit, the current would rush to this spot, because it would afford an easier passage than through the lamps. Such a low resistance would be offered if the conductors were brought together by any accident; and, in the absence of a safety device, the consequence would

be the melting of the wires and possible danger of setting fire thereby to any adjacent inflammable material. It is to provide against this danger that the safety-catch is placed in the path of the current. The fusing point of the lead wire in the safety-catch is between 450 and 500 degrees Fahrenheit, while it requires about 2,143 degrees to melt copper of proportionate size. The safety wire is placed in a closed receptacle which is screwed into the place designed for it, in the same manner as a lamp. If, therefore, the wires should become overcharged from any cause, this safety-catch would at once melt off harmlessly and open the circuit, thus preventing the flow of current and averting all possible danger from fire. The circuit can be again closed by taking out the safety-plug and putting in a new one—the work of a moment.



The Edison Safety-Catch.

Under the Edison system, fires are impossible. Not only are the wires thoroughly insulated, and also, when necessary, protected by mouldings, but the "cut-out" is so introduced in the path of the conductor that fire from the source above-named, or from any source whatever, is absolutely impossible. The lamp is now in general use in factories, dwellings, theatres, steamships, &c., yet *no fire has ever taken place* from the Edison system.

STEAMBOAT LIGHTING.

The light, besides being available for dwellings and factories, is also especially adapted to the lighting of steamboats. The cleanliness, absence of disagreeable odor, ventilation, freedom from danger by fire, and economy, make the light better for steamboats than any other known illuminant. The lamp has also been found of the greatest value for the examination of the parts of a vessel under water.

LIGHTING OF MINES.

The lamp is also used for lighting mines. Mr. Edison has invented devices for protecting the lamp from breakage, even from the roughest handling, and for making the light absolutely safe from explosion or fire, even if breakage should take place in the presence of fire-damp.

TRANSMISSION OF POWER.

The Edison system supplies power as well as light. By the use of the dynamo, power may be transferred from a source of power to distant points for use, or from one portion of a factory to another. This invention affords not only the cheapest method, in many cases, of transferring power, but also facilities for minute sub-division and complete control.

Among the many uses made of the electric power are the following: the running of lathes, printing-presses, sewing machines, other small machines, elevators, and pumps.

LIGHTING OF CITIES.

The Edison system for lighting large cities is modeled on the existing gas system. The current is generated at a central point, is distributed through conductors laid under the streets, connections are made with houses by means of branch conductors, and the current thus diverted, after passing through a meter, which registers with perfect accuracy the quantity consumed, is distributed through the house for use either for light or power. Houses are so wired

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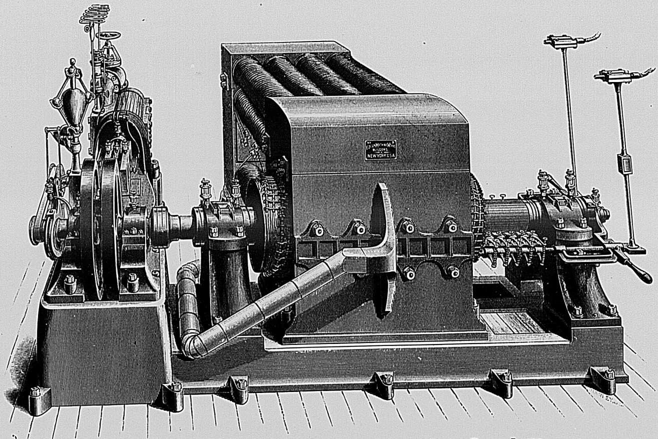


The Edison Central Station Dynamo for 1200 Sixteen Candle Power Lamps.

that not only is light supplied, but, by means of an electric motor, power is also furnished for any purpose.

A cut of the standard Edison dynamo used in large central station systems is shown on the preceding page. This machine will generate current for 1,200 sixteen candle-power lamps.

ECONOMY.

The economy of the Edison incandescent light, as compared with gas, is beyond question, no matter whether the gas is obtained through the ordinary distribution system, as in cities, or is manufactured on the premises of the consumer by a portable gas machine. In estimating on the subject of economy there are many important elements to be considered, among which are the effective light obtained, the difference in cost of steam and water power, the number of hours per year during which the light is used, &c., &c. Again, in comparing our light with gas, the fact should be taken into consideration that the illuminating power of gas varies in different localities. The 5-foot gas burner does not *ordinarily* give a light equal to 12 candle power, so, in order to obtain the same amount of light as that given by the Edison standard lamp (16 candle power), a 7½-foot gas burner must be used. Even then the whole light of the gas burner cannot be utilized, because it can neither be inverted nor entirely backed up by a shade, while, on the other hand, the whole candle power of the Edison lamp is effective, inasmuch as it may be inverted or otherwise directed to any desired spot.

The items which enter into the cost of running a plant, in a cotton mill for instance, are as follows, viz.:

1. Cost of coal for generation of steam, or rent of water power.
2. Depreciation on machine.
3. Renewal of lamps.
4. Oil, waste, &c.

The first item needs little comment from us, the cost of power being familiar to every manufacturer. We should say, however, that we have learned from several of those who are using large Edison plants, that they do not consume any more coal than they did before using our dynamos. This would appear to be a startling statement, but we believe from the information we have obtained, that it is nevertheless correct. This statement relates to those mills where they do not work nights, and where artificial light is only used from 300 to 600 hours per year. In this case the firemen do not put any coal on their fires for some time previous to shutting down in the evening, and it is during this time that the light is required. Consequently no additional coal is required for the steam used to drive the dynamos.

A very important item relating to the cost of power for our machines is their efficiency in the conversion of steam into electrical energy. From tests made at the Stevens Institute of Technology by Mr. John W. Howell, it is found that the Edison dynamo converts into electrical energy *95 per cent.* of the mechanical energy or indicated horse power of the engine or other motive power, and the Edison System of Lighting converts *88 per cent.* of such original mechanical energy *into light.* (See text of Mr. Howell's report, also of report of Professors Brackett and Young, page 22.) The above results are *far in excess* of those attainable by any other known method of applying electricity to the production of light. The economy and efficiency thus attained make the Edison system *vastly cheaper* than any other now known. We give a written guarantee that our dynamos will furnish current to light at least six standard 16 candle lamps for every horse-power indicated by the steam engine driving such dynamos.

The only depreciation on the dynamo machine is the natural wear of the journals and boxes, commutator, and brushes, the total of which with ordinary care does not exceed *one per cent. per annum.* The lamps at their normal candle power are *guaranteed* to have an average life of not less than 600 hours, but their actual life has been found in practice to be much longer. In some cases, where power was abundant, it has been found by purchasers of our plants

that by running our lamps very slightly below their normal candle power and adding a few extra lamps to make up the total amount of light required, the average life of the lamps has exceeded *1,500 hours of actual burning.* The lamps cost one dollar each. No expense for extra labor is necessary, except in the case of a very large plant, say, over 1,000 lights, and even then a part only of one man's time need be occupied.

This question of the economy of the Edison light has received so much attention from the purchasers of our plants, that we present the statements of a few of them below:

The following is copied from the Boston *Cotton, Wool and Iron:*

"In answer to an inquiry as to the result of the introduction of the Edison system of electric lighting in the Wamsutta Mills, we have received the following letter:

WAMSUTTA MILLS,

NEW BEDFORD, MASS., Nov. 10, 1882.

Editor Cotton, Wool and Iron:

The Edison system of electric lighting was introduced into our No. 6 mill, Sept. 14, 1882, and has been in constant use ever since that date, lighting the entire mill. The plant cost about $12,000, and consists of three K dynamos, so called, each of the capacity of 250 A lights of 16 candle power each, making a total of 750 lights. The lights are so arranged that one will light four looms, giving an equal amount of light to each loom. We formerly used two four-foot gas burners for the same purpose. In other parts of the mill the arrangement is such that one lamp lights about the same space as two four-foot gas burners. The whole system from the word go has moved along without a hitch of any name or nature, and is giving entire satisfaction. We like it for several reasons. It is better light than gas; it is as cheap as gas at $1 per 1,000 feet; there is no smoke or heat from it; it is safer than gas; and, best of all, it does not vitiate the air we live in—for this reason alone we should use it, if it cost more than gas. The dynamos are operated by one of our machinists, requiring but a small portion of his time, say an hour and a half per day for the year. The power required is, by actual test, one-horse power for 8.6 lights of 16 candle power each. The lamps are guaranteed to last 600 hours; and, as a well constructed mill requires light but about an hour per day, or 300 hours per year, the lamps would last two years. The cost for power, taken in connection with the power to drive our mills, is very light, at the night end of the day. We are unable to detect any increase in the consumption of coal; but the fires are probably burned a little lower; therefore, from this data, I should compute the cost of lighting our mill, which contains 51,000 spindles and 1,072 forty inch looms, as follows, putting the power at $30 per year per horse power:

87 horse power for 300 hours at $30	$261	
375 lamps at $1 each	875	
Labor operating dynamos	90	$726
Interest and wear and tear on plant at 8 per cent		960
The total cost of electric light		$1,686

To light with gas would require 1,200 four-foot burners, which would consume 1,440,000 feet of gas in the 300 hours.

1,440,000 feet gas at $1 per thousand foot	$1,440
Interest, etc., on cost of piping mill, at 8 per cent	320
Total cost of gas	$1,760
Deduct cost of electric light	1,686
Leaving	$74

Showing $74 in favor of electric light with gas at $1 per thousand feet.

Yours, respectfully,

EDWARD KILBURN, Agent."

The following extract is from the Holyoke *Transcript*, October 28th, 1882:

"At a meeting of the Manufacturers Mutual Insurance Co., held in Boston, last Wednesday, Mr. Charles J. H. Woodbury, a mechanical engineer of much prominence, who is retained as an expert by that company, read an exhaustive paper on electric lighting, a portion of which is of much local interest.

Mr. Timothy Merrick, of this city, authorizes him to give the facts respecting his experience with the Edison System in the Merrick Thread Company's mill No. 3. This mill runs all night, five nights in the week for 51 weeks per year, using light 2,869 hours per annum. It was lighted by 95 burners with city gas, costing $2.13 net, which amounted to $225 per month. Ninety-five Edison B burners (eight candle power) were substituted for the gas. In the first 1,000 hours five lamp-carbons had broken, and October 20 they had been in use 1,278 hours, and eleven had broken.

Allowing that the lamps average six months use, the cost of lighting is made up as follows:

190 lamps at $1.00	$190 00
Interest and depreciation	153 50
6 horse power at $10.00	60 00
Annual cost of Edison light	$403 50
Monthly " " "	33 62
Monthly cost of gas	225 00

The results from these lamps are very satisfactory, and certainly in excess of what would have been obtained if the lamps had been forced beyond their normal capacity.

The Holyoke Water Power Company furnishes water power very cheaply; and the result may be interesting if we hold the Edison Company to their minimum guarantee, and also charge the dynamo with four pounds of coal per hourly horse power:

4.78-100 renewals of 95 lamps, equals 454 lamps at $1.00	$454 00
Interest and depreciation	153 50
30.74 tons of coal, at $5.75	176 81
Annual cost of Edison light	$784 31
Annual cost of gas	2,700 00
Monthly cost of Edison light	65 36

which is equal to gas at 65 cents per thousand.

'The mill is situated,' says Mr. Woodbury, 'at the base of a high bank and is only eleven feet, six inches between floors, so it is very hot in summer, and Mr. Merrick informed me that it would have been impossible to run the mill nights during the extremely hot season last summer if the help had been subjected to the heat and vitiated air from the burning gas.'

Speaking of improvements Mr. Woodbury says 'that they will certainly come, but will probably refer to attachments rather than to the more permanent portions of the plant, as the machines already deliver 80 or 90 per cent. of the motive power into electricity upon the conducting wires.' * * * More than 33 per cent. of the arc lighting plants on premises insured by the Mill Mutual Insurance Companies have caused fires, but he gives no instance of one caused by an incandescent system, and it is positively asserted that no fire or injury to person has ever been caused by an Edison system."

The following extracts are from a letter written by Mr. F. E. Clarke, in reply to an inquiry as to the efficiency and economy of the Edison plant in the Pemberton Mill, Lawrence, Mass.:

"We put in one Z dynamo, 65 A or 120 B lights, in October, 1881, and at first tried the 120 B lights with it, lighting 120 looms, with one light to a loom. From what I saw in New York, I became convinced that the A lamp, using half as many, would serve us better, consequently I made the change, getting 65 A lamps in running order in January, 1882. With these A lamps we lighted 130 looms. The many advantages of the light, some of which were—almost perfect condition of the atmosphere when using no gas jets, discrimination of colors, little imperfections in weaving remedied more quickly by the weaver, a better diffusion of light among the machinery, enabling quicker renewing of warps in looms, and quicker repairing of breaks in warps or machinery—all of which were experienced in using the light through the winter of 1881 and 1882, and up to September of 1882—decided me to increase the number of lights so as to light wholly two entire weaving rooms. I therefore contracted for 2 L dynamos, 150 lights each, giving me in all 365 A lights. These were all in operation early in November, 1882, and have been in use continually since. After a week's use I had taken out of the two rooms all of the gas jets except 4 in each room, which are used in case of stopping of electric lights, that no panic may be occasioned among the help. The electric machines are driven by the regular power of the mill (water wheels), and once in a while a short stop is necessary from some breakage of shaft or large belt, etc.; hence, the few gas jets spoken of above. The operation of the machines and lights through the mill thus far have been very satisfactory. We make colored goods largely. Our weave rooms are wide, and in dark days, and in fact, nearly, if not quite, every day we have used a part of the lights all day. The difference in the atmospheric condition of the rooms from what they were when we used gas is almost indescribable. In the evening, when all lighted, the air is as pure to the health and sight as it is in the full sunlight.

I have the light at my desk in the office, and its steadiness, and the absence of heat rays, make it very pleasant, and I am able to write and read as long as I choose, without any inconvenience to my eyes. * * *

Now for comparative economy of gas and electricity.

We have 365 A lights.

We used during January, 1883, 135 lamps all day (10 hours).

We used during January, 1883, 230 lamps, 2 hours each day, equivalent to 181 lamps all day, 10 hours each day; as we displaced 2 gas jets with each A light, we displaced 362 gas jets.

362 gas jets, ten hours, 4 feet per hour, gives 14,480 feet gas. 14,480 feet gas, at $1.65 per thousand,—$23.89 *as daily cost of gas* to obtain a poorer light.

Electric plant cost entire, $6,825.60.

12 per cent. of $6,825.60 for interest and depreciation, one day	$ 2.73
Power eight-tenths of one cent per H. P. per hour, for 181 lights 28 H. P.	2.24
Lamps, 181 lights; renewal 4 lamps daily	4.00
Extra cost, man and oil, etc.	1.25
$10.22 *cost daily of* 181 *Edison lamps, 10 hours per day.*"	$10.22

We would also call attention to the following letter from a prominent Philadelphia firm of hat manufacturers:

MR. JOHN HOSKIN, AGENT, "PHILADELPHIA, May 2d, 1883.

Edison Company for Isolated Lighting:

DEAR SIR—In reply to your request, we give you our full permission to refer to us on the subject of the Edison electric light, and our use thereof. We commenced by using

a 60-light dynamo, and shortly after added a second one. After a year's trial we concluded to light our whole establishment with it, and therefore increased our plant this winter to five hundred (500) lamps, of sixteen candle power each. The plant for this consisting of two Edison dynamos, of two hundred and fifty (250) lamps each, and a suitable steam engine for driving them was furnished by you; and it gives us pleasure to acknowledge your care in fulfilling every obligation that you had entered into in setting up this electrical equipment. Our whole establishment is now lighted by electricity, as we have found the light to be bright, and steady to work by on our darkest goods; pleasant to the eyesight, free from danger by fire, and from our late tests we find it to cost us, as near as we can calculate, 38 *per cent.* of what gas would cost us at $1.90 per 1,000 ft.

Very respectfully yours,

JOHN B. STETSON & CO."

The following testimonial is from another well known Philadelphia firm:

FAIRMOUNT WORSTED MILLS,

Office—106 Chestnut Street.

PHILADELPHIA, May 10, 1883.

MR. JOHN HOSKIN, AGENT,

Edison Co. for Isolated Lighting, Room 6, Ledger Building, Philada.:

DEAR SIR: In response to your request for statement of cost of Electric Lighting at our mill by the Edison Incandescent System, we submit the following:

Number of hours plant lighted since installation of first Dynamo..........1562

Average *hourly* consumption of gas before introducing Edison Light..2,170½ feet

Or, for 1,562 hours, 1,562 × 2,170½ ft. = 3,399,693 feet, costing 3,399 $\frac{693}{1000}$ × $1.90. $6,459 41

Actual cost of gas used in addition to Electric Light 1,391 56

Actual value of gas light supplanted by Electricity.................. ....$5,067 85

Our expenses for the Electric Light to supplant this have been as follows, viz.:

For Installation of Light, including all expenses of every kind, and Lawrence engine for driving, $12,006 40.

4 months' interest on same @ 6 %....................................	$240 13
91½ tons coal @ $3.25..	297 37
Oil used..	93 43
Lamps destroyed, 443..	443 00
Repairing armature..	47 05
Total..	$1,131 88

Total cost gas light supplanted........ ....$5,067 85

" " Electric Light.. 1,131 88

NET SAVING.................................$3,935 97

Comparative cost of gas light to the Electric nearly as 5 to 1.

Trusting you will find our method of calculation a reasonably practical one, we are,

Yours truly,

FISS, BANES, ERBEN & CO.*

*One other item should, we think, be added to this letter, namely, depreciation on plant. The total cost of the plant was $12,006.40, including an independent engine. A very large part of this amount, however, covers wiring, fixtures, &c., which do not depreciate, leaving only the active parts of the plant upon which this expense will fall. If, therefore, we charge ourselves with 3 per cent. ($120.07) for four months on the total cost for depreciation on dynamo *and engine*, we still have a net saving, by use of the Edison light, of $3,815.90.

We have letters from others touching the economy of the system, but think that those above given will be sufficient to stimulate interested enquirers to make further investigation of the facts. Other letters on this point, as well as on the general efficiency of the system, will be found among the testimonials in another part of this book.

While on this subject of the cost of the light and its economy, it will be found interesting to examine the following tables, showing the cost of production of the light, which have been prepared by us from data obtained by actual experience.

COST OF OPERATING AN EDISON 400-LIGHT PLANT WITH 65-HORSE POWER TAKEN FROM MAIN SHAFT OF A MILL; EACH LIGHT GIVING A SPHERICAL ILLUMINATION OF 18 CANDLES AND EQUAL TO A 7½-FOOT COAL GAS BURNER.

	300 Hours pr. Year.	600 Hours pr. Year.	900 Hours pr. Year.
Interest on cost, say $6,100, at 6 per cent..............	$366	$366	$366
Depreciation on $700..................................	70	100	125
" on $5,400...........	162	162	162
Coal, 1¼ cent per hour for each horse power...........	244	488	732
Renewals of Lamps..................................	200	400	600
Oil and waste..........................	20	30	40
Insurance, at .05 per cent....	19	19	19
Total annual running expenses.............. ..	$1,081	$1,565	$2,044

COST OF 400 GAS BURNERS, EACH HAVING 18 CANDLES SPHERICAL ILLUMINATING POWER, AT $2.25 PER 1,000 FEET.

	300 Hours pr. Year.	600 Hours pr. Year.	900 Hours pr. Year.
400 7½-foot burners—3 M feet per hour—$6.75 per hour.	$2,025	$4,050	$6,075
Cost of Edison Light as above	1,081	1,565	2,044
Saving per annum	$944	$2,485	$4,031

As will be seen from the foregoing tables, the comparative cost of the electric light becomes less as the number of hours of annual consumption increases, for the reason that the item of interest remains constant. Furthermore, this estimate of running expenses is based upon the assumption that the lamps will last only 600 hours, whereas it has been found in practice that they very much exceed our guarantee, which materially diminishes the cost of producing the light. It should also be borne in mind that an Edison sixteen-candle lamp will give, in practice, the same light as that obtained from an ordinary gas burner consuming 7½ feet of gas per hour. The effective illumination of our lamp, in comparison with a gas jet of equal power, is 25 per cent. greater, owing to the facility of throwing the light where it is wanted.

We also give, on page 19, an estimate of cost of operating Edison plants, as compared with gas and arc lights, prepared by Mr. Sidney B. Paine, of our New England department.

GENERAL ADVANTAGES.

When to the pecuniary economy is added the healthfulness of the light as compared with gas, its freedom from odor and from danger by fire; its steadiness, adaptability, completeness and beauty, there can be no doubt that the Edison light is unsurpassed by any other method of artificial lighting whatever.

There is abundant evidence of the satisfaction given by the Edison system of lighting wherever it has been introduced, as will be seen from an examination of some of the testimonials we have received, which will be found in another part of this pamphlet. Apart from these, however, the most gratifying evidence of the merits of the system is the fact that a large number of our plants have been increased by purchasers, after trial. A partial list of these plants increased by purchasers, after trial, is given below:

NAME.	ADDRESS.	FIRST PLANT LAMPS.	INCREASED TO.
Danforth Locomotive Works	Paterson, N. J.	60	150
Pemberton Company	Lawrence, Mass.	125	375
Merrick Thread Co.	Holyoke, Mass.	120	400
Wamsutta Mills	New Bedford, Mass.	60	750
Weed, Parsons & Co.	Albany, N. Y.	120	600
Max Ams	New York City	15	60
Sayles & Washburn	Mechanicsville, Conn.	120	300
George Urban & Co.	Buffalo, N. Y.	15	60
Norton, Brother & Co.	Chicago, Ills.	15	60
Sibley Manufacturing Co.	Augusta, Georgia	450	600
Fiss, Banes & Erben	Philadelphia, Pa.	250	500
Baltimore *Sun*	Baltimore, Md.	150	250
Worumbo Manufacturing Co.	Lisbon Falls, Me.	150	650
J. B. Stetson & Co.	Philadelphia, Pa.	200	500
Eastman Dry Plate Co.	Rochester, N. Y.	15	60
Davenport *Gazette* Co.	Davenport, Iowa	60	150
Magasins du Bon Marché	Paris, France	500	2,500
R. Loeffel & Co.	Blainville, France	60	210
Alsace, Lorraine R. R. Co.	Strasbourg, Germany.	60	1,200
Finlayson & Co.	Tammerfors, Finland.	300	650
Waterloo R. R. Station	London, England	120	210
Old Kentucky Woolen Mills	Louisville, Ky.	250	350
D. Goff & Sons	Pawtucket, R. I.	60	350
Boston *Herald*	Boston, Mass.	150	500

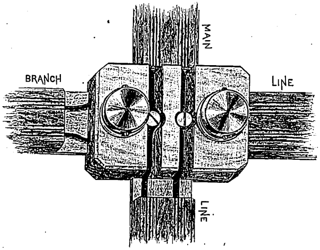
In addition to the above the two following increases are especially noteworthy:

(1) Messrs. Seymour, Sabin & Co., Stillwater, Minn., and the Merrimac Manufacturing Co., Lowell, Mass., each increased the dynamo capacity of their plants from 250 eight-candle lamps to an equal number of sixteen-candle power lamps.

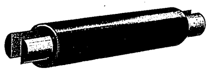
(2) Messrs. H. K. & F. B. Thurber & Co., New York City, have twice increased their plant. The first installation was of 60 lamps, which was increased to 176, and again to 250 lamps.

WIRING BUILDINGS.

The wiring of buildings is done by experienced workmen, with none but first-class material. All wires are doubly insulated, and, in most cases, protected by wooden mouldings, as shown in the following cut:



The above cut shows the main and branch lines, the safety-catch being inserted in the latter. In the cut one part of the wooden moulding is shown as being slipped from over the wires, to illustrate the fact that they are kept a proper distance from each other in accordance with insurance regulations. In large plants where heavy conductors are required, we use for the main lines the Edison patented conductors, which are enclosed in an iron tube filled with an insulating compound. These tubular conductors are shown in the cut below:



ESTIMATES OF COST.

We can at any time make accurate estimates of cost of installing a plant, requiring only a detailed plan of the building or buildings to be lighted. This plan should show the proposed location of the dynamo, the location and description of the rooms and machines to be lighted, also the total number of lamps required. An elevation, showing the height of ceilings, should accompany this diagram.

All installations are made with great care, and under the rules and regulations laid down by the New York Board of Fire Underwriters. It is only just to ourselves to state that we have in all cases taken particular pains to install our plants in strict accordance with such rules, and that in no case has a permit to use the Edison light been refused by the insurance companies, with whom our relations have been most satisfactory and agreeable. The indications tend, we believe, very generally towards the opinion that the use of our system is for all purposes attended with a far greater degree of safety than where gas or kerosene is used.

PRICE LIST.

The cost of each dynamo, which includes lamps and sockets, as well as a hand regulator, is a constant, the cost of wiring, fixtures and other accessories to complete the plant depending upon the number, disposition and grouping of the lamps and upon the quality of fixtures required. A price list is given on page 60, from which it will be easy for any person to make an approximate estimate of the cost of any capacity of plant required.

ENGINES.

Where a special engine is required to run the dynamo, we can supply one peculiarly adapted for the purpose.

This engine is built by the Armington & Sims Co., Providence, R. I., and has been modified in accordance with the suggestions of Mr. Edison and the engineering department of this company. We have supplied a large number of these engines in connection with some of our plants, and they have never failed to do their work perfectly and with entire satisfaction to the customer.

On page 63 and those following we present cuts of these engines together with tables showing the dimensions, powers, and speed of the same.

We also present, on the pages following the above, a series of diagrams giving the dimensions, &c., of foundations required for engines and dynamos, which will be of use to those contemplating the purchase of a plant.

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COST OF THE EDISON LIGHT COMPARED WITH ARC LIGHT AND GAS.

Mr. Sidney B. Paine, connected with the New England Department of the Edison Company at Boston, has recently prepared a valuable paper on the cost of the Edison system of incandescent lighting, compared with arc lights and gas in factories. His paper, printed in the *Cotton, Wool and Iron*, Boston, April 14th, is copied below :

"We publish below, as nearly as we can ascertain, the absolute facts of the cost as between the arc and incandescent systems of lighting. We believe it will be of interest to manufacturers, and it will be seen that the data given is intended to be from the standpoint of absolute accounts which have been verified by manufacturing concerns.

This estimate is based upon the requirements of a weave shop containing 1,000 forty-inch looms manufacturing white shirtings. To light this room properly will require 40 arc lamps (one lamp to twenty-four looms), or 250 Edison 16 candle-power lamps (one lamp to four looms). This distribution of the light is the one which has been found, in actual practice, to give equal result.

The estimate on the running expenses of the arc system is based upon a statement made by Col. Thomas Livermore, before the New England Cotton Manufacturers' Association, in October, 1882. This gentleman is using 464 arc lights (about half being Brush, and one-half Weston) in the Amoskeag Mills, in Manchester, and has kept very accurate accounts of the expenditure entailed by these systems. The estimate upon the running expenses of the Edison system is also based upon actual practice. From this experience the Edison Company has made full guarantees, thus protecting the manufacturer. As the Edison Company has protected itself in making these guarantees, the manufacturer will realize better results than those given below. These latter expenses are therefore the maximum.

FORTY-TWO ARC LAMPS.

This plant, as installed by the Brush Company, will cost $7,000, including wiring. The power required will be 42 horse-power, which at 1$\frac{67}{100}$ cents per horse-power per hour ($50 per horse-power per year), will cost 70 cents per hour.

The "labor, carbons, and repairs," at 2$\frac{88}{100}$ cents per lamp per hour, will cost $1.21 per hour.

The "depreciation," as estimated by Col. Livermore, amounts to $2.10 per hour per lamp, equal to eight cents per hour on plant in question.

TWO HUNDRED AND FIFTY EDISON LAMPS.

This plant, as installed by the Edison Company, will cost about $4,000, including wiring. The "power" required will not exceed 35 horse-power, which, at 1$\frac{67}{100}$ cents per horse-power per hour, will cost 58 cents per hour. The "lamps and brushes," estimating that the Edison Company is called upon to make good its guarantees of an average life of 600 hours for the lamps (renewal $1 each) and of 200 hours for the brushes ($10 per set), will cost 47 cents per hour. The "depreciation" of the Edison system, assuming that the Edison Company is required to make good its guarantee of 1,500 hours' life for the "commutator" (renewal $50), will amount to three (3) cents per hour. There is no cost for "labor" connected with the Edison system, other than that included in the charge of 1$\frac{67}{100}$ cents per horse-power per hour, inasmuch as the dynamo can be placed in the engine room, and the engineer can pay it all the necessary attention without interfering with his legitimate work. This charge (1$\frac{67}{100}$ cents per horse-power per hour) is extremely high. It covers all labor of engineer and fireman, fuel, water, oil, waste, and all depreciation, interest, taxes and insurance on steam plant, consisting of engine, foundations, heater, boilers, piping-stack, engine and boiler-house. These charges, in an ordinary equipment, ought to be covered by $40 per horse-power. While this basis may answer for the purposes of the present comparison (as both systems are brought to the same basis), it is evidently improper to adopt it in comparing either of the above systems with any other, unless such other be first brought to the same level.

Tabulating the comparative estimates given above, we have the following running expenses (exclusive of interest) for lighting the above room for one hour :

	42 Arc Lamps, $7,000.	250 Edison Lamps, $4,000.
Power	$0.70	$0.58
Labor, carbons, lamps, repairs	1.21	.47
Depreciation	.08	.03
Hourly expense, exclusive of interest	$1.99	$1.08

To light the above room with gas would require 500 4-foot burners. The piping for the above number of burners would cost, at the lowest estimate, $1,500. These burners would consume 2,000 feet per hour, which, at $1.60 per thousand, will cost $3.20 per hour.

If, instead of steam power, as figured above, water power is used, the cost will be very materially reduced. In Lewiston, water power sells for $5 per horse-power per annum; interest on the plant and labor will not exceed $5 per horse-power, bringing the outside cost per year to $10 per horse-power. On this basis, the power necessary to produce the arc lights in above example will cost 14 cents per hour, and to produce the 250 Edison lights, 12 cents per hour.

The following table gives a view of the comparative hourly expense (including interest) of lighting the above room by the three systems; the "lighting time," or time during which light is required, is assumed to vary from 300 to 3,000 hours per year, in order to cover all probable cases, and the hourly expense is reckoned accordingly. Appended to this table are four columns, showing the saving (reckoned as a percentage on the first cost —$4,000 —of the Edison plant) obtained by the use of the Edison light over the arc system and gas:

Running Time.	Gas at $1.60	Steam Power.				Water Power.				Saved by Edison.			
		Arc.	Edi-son.	Equiv. of Gas		Arc.	Edi-son.	Equiv. of Gas		Steam.		Water.	
				Arc.	Edi-son.			Arc.	Edi-son.	Arc	Gas.	Arc	Gas.
300	$3.50	$3.39	$1.88	$1.55	$0.86	$2.80	$1.42	$1.28	$0.65	11%	12%	10%	16%
400	3.46	3.04	1.68	1.42	.78	2.45	1.22	1.14	.57	14%	18%	12%	22%
500	3.38	2.88	1.56	1.34	.74	2.24	1.10	1.06	.52	16%	23%	14%	29%
600	3.35	2.69	1.48	1.08	.71	2.10	1.02	1.00	.48	18%	28%	16%	35%
700	3.33	2.59	1.42	1.24	.68	2.00	.96	.97	.46	20%	33%	18%	41%
800	3.31	2.52	1.38	1.22	.67	1.93	.92	.93	.45	23%	38%	20%	48%
1,000	3.29	2.41	1.32	1.17	.64	1.82	.86	.89	.42	27%	50%	24%	61%
1,250	3.27	2.33	1.27	1.14	.62	1.74	.81	.85	.39	33%	63%	29%	77%
1,500	3.26	2.27	1.24	1.11	.61	1.68	.78	.83	.38	39%	70%	34%	93%
2,000	3.25	2.20	1.21	1.08	.60	1.61	.74	.79	.36	50%	102%	43%	120%
3,000	3.23	2.13	1.16	1.05	.57	1.54	.70	.76	.35	73%	155%	63%	190%

The collateral advantages, however, are all with the electric lights. The gas heats the room and vitiates the air. In the room in question it dried up the moisture from the vapor pots, an evil which a practical weaver will readily comprehend, as it causes the yarn to "kink." It discolors the ceilings, thus absorbing the light. These defects are all wanting with either of the electric light systems in question, and not only can better work be done, and larger production be obtained, but a manufacturer using the electric light is able to select from an abundance of help, and thus secure the best, while his gas-lit neighbor suffers from inferior workmanship, and a scarcity of laborers. But, possessing these advantages in common with the arc light, the Edison system goes further. Its light is absolutely steady, while everyone is familiar with the flickering of the gas flame or arc lamp. Unlike the latter, shutting off lamps saves power in proportion, and should it be necessary to stop, say four out of the twenty-four looms, it is not necessary to consume a horse-power for twenty which continue to run, as each Edison lamp may be turned off, entirely independent of the others, and one-seventh of the power will be saved. Again, on "dark days" it is necessary to light the centre of the room before the sides. The arc lamps named above being "in series" on one circuit, must be switched off each in turn, and then, with no saving in power, as it is impossible to shut off more than three-tenths of the lamps on those circuits without throwing in an equivalent resistance either by other lamps or resistance coils. On the other hand, the Edison lamps are arranged in several distinct circuits, each of which runs the length of the room, and parallel to the others. By switches the entire line may be shut off at once, with a resulting economy in power. An automatic regulator is provided which, as lamps are turned off in the rooms, inserts resistance in the magnet circuit (*not* in the direct circuit, or the circuit in which the lamps are placed with the arc lights), thus allowing less current to pass around the magnets. These magnets, therefore, become weaker, and less power is required to turn the armature. The Edison is the only electric light company using an automatic regulator, whereby an absolutely steady and uniform light is maintained, irrespective of both the load and speed of the armature, within reasonable limits; that is, it cannot produce light when the dynamo is at rest, nor entirely adjust should that speed be doubled. The former case is not expected, and the latter never occurs in practice. The fires, stated in the daily papers as being produced from the "electric light," have been due to the arc light; no insurance company has ever been called upon to pay a cent on account of damage by the Edison system. The reason is obvious. Edison uses an automatic safety device, which is absolute in its action. It acts on the same idea as the automatic sprinkler, and is even more sure. Only the one, or at most three lights, on the "tap" would be extinguished in case of an accident, as each tap is protected by its own safety-catch. The use of such an arrangement on an arc light circuit is theoretically possible, but it is utterly impracticable. The arc lights are, so to speak, strung along one wire, the current for the second passing through the first; any break in this circuit will instantly extinguish every one of the lights on the machine—a most serious objection, as a panic would inevitably ensue among the operatives. Again, break-downs on the looms usually occur below the lathe, and as the dense shadows cast by the arc lamp render repairs by its aid out of the question, oil lamps must be used to the great discomfort and disadvantage of the mechanics. Edison has a lantern which may be attached by means of a flexible cord to the socket over the loom or other machine. This lantern may thus be carried about within a radius of the length of the flexible cord. The lantern may be carried to any part of the room, and there made available about any machine by detaching it from one socket and attaching it to another.

The current produced by the Edison dynamos is perfectly harmless, it being impossible to produce injury to the person by its passage through the body. An ordinarily close reader of the daily papers cannot fail to have been struck with the number of accidents resulting from the use of the arc light or gas.

Thus, for cheapness in first cost, economy in running expenses, and general efficiency and desirability, as well as safety to the person and property, the advantage seems to be entirely on the side of the Edison system, as compared with the arc system or gas. Its superiority to either of the other systems is not confined to the illumination of weave shops; an equal advantage will be found in either the spinning, spooling, carding, or other departments of a cotton, woollen or worsted mill.

In machine shops, or other places where *special* light is required, the Edison system stands without a rival.

ECONOMY OF THE EDISON DYNAMO-MACHINE.

Report of comparison between the Prony and Edison Dynamometers, and upon the efficiency of the Edison Dynamo-electric Machine, by Professors C. F. Brackett and C. A. Young, of the College of New Jersey, Princeton, N. J.

Experiments made April 3, 1880.

First Comparison Between the Dynamometers.

The lever arm of the Prony was held down by the action of a spring balance applied at division 12, corresponding to a virtual circumference of 12 feet. The weight of the balance was 5.41 pounds, which is to be added to all its readings. The balance was read by Mr. Upton. After the experiment, the Edison dynamometer, transmitting no work, as read by Prof. Brackett, indicated (the mean of five readings, ranging from 900 to 995) 994.2 pounds. During the experiment the readings were made by Prof. Brackett and recorded by Prof. Young.

Duration of test, 10 minutes.

Number of revolutions of Prony shaft, determined by counter, 5,664.

Number of revolutions of main shaft, 1,880.

Mean indication of Edison dynamometer, deduced from Prof. Brackett's ten readings, varying from 920 pounds at beginning to 935 at end of experiment, 925.7 pounds.

From this, taking the mean reading of the zero, 994.2 pounds, we have $\frac{994.2-925.7}{2} = 34.25$ pounds.

Mean tension on Prony arm, 9.011 pounds, varying gradually from 10.91 pounds at beginning to 7.66 pounds at end of experiment, including weight of scale.

Work registered by Prony, 9.011 (lb.) × 12 (ft.) × 5.664 (rev.) = 612,460 ft. lb.

The diameter of main pulley is 38 inches.

The angle between belts of Edison dynamometer is taken at 44°. Assume $K = \left(\pi \times \sec. 22^\circ \times \frac{38}{12}\right) = 10.7297$. Then the Edison dynamometer registered K (ft.) × 1880 (rev.) × 34.25 (lb.) = 690,880 ft. lb. That is, the Prony recorded 88.6 per cent. of the work carried by the Edison dynamometer.

The comparison does not seem to us satisfactory on account of the considerable change in the conditions during the experiment.

Second Comparison.

Constants and observers as before.

Duration of test, 4 minutes.

Number revolutions of Prony, 2,281.

Number revolutions of main shaft, 752.

Mean tension on arm of Prony, 11.35 lb., varying from 11.60 to 10.97 in seven readings.

Initial reading of Edison dynamometer (mean of five), 994.2.

Final reading of Edison dynamometer (mean of five), 994.2.

Mean during comparison, 911.57.

(Mean of seven readings, varying from 910 to 915 lb.)

Work according to Prony, 11.35 (lb.) × 12 (ft.) × 2,281 (rev.) = 310,680 ft. lb.

Work according to Edison instrument, K (ft.) × 752 × $\left(\frac{994.2 - 911.57}{2}\right)$ = 333,300 ft. lb.

In this comparison the Prony registers 93.2 per cent. of work indicated by the Edison dynamometer.

We regard this test as fairly reliable, the conditions having been very constant, and the outstanding difference of 6.8 per cent. being reasonably accounted for by slip of belts and friction of journals between the two dynamometers.

Tests of the Efficiency of the Dynamo-Electric Machine.

During both these tests the thermometer of the calorimeter and the Edison dynamometer were read as often as every minute, and great pains were taken to keep the water thoroughly stirred. The calorimeter was a galvanized iron vessel, 16.42 inches in diameter and 24½ deep.

The wire coil was wound upon a light wooden frame, so constructed as to serve as a very efficient stirrer.

The thermometer was an excellent instrument, by James Green, graduated to fifths of a Fahrenheit degree, each degree being about three-sixteenths of an inch in length.

Prof. Brackett read the dynamometer.

Prof. Young read the thermometer and made the records.

Mr. Upton and others, the speed of the main shaft and the indications of the high resistance galvanometer in the laboratory.

Constants.

Weight of calorimeter (empty)....	22.63 lb.
Heat capacity of same (taking specific heat at 0.112).	2.53 lb.
Weight of wooden frame....	5.71 lb.
Heat capacity of frame (s. taken at 0.30)....	1.71 water lb.
Weight of wire coil (54¼ turns, each turn weighing 5.84 grammes)....	0.70 lb.
Heat capacity of wire (s., 0.10)....	0.07 water lb.
Resistance of coil in calorimeter....	1.720 ohms.
Resistance of leading wires taken as $\frac{1}{300}$ of coil....	0.0057 ohm.
Resistance of wire on revolving armature....	0.140 ohm.
Resistance of coil on field magnets....	1.470 ohms.

First Test.

Total weight of calorimeter with contained water and everything in place	197.5 lb.
Hence from preceding data the heat capacity of whole.	172.77 water lb.
Temperature of air....	72.2°
Temperature of water at beginning....	63.8°
Temperature of water at end....	80.5°
Gain during experiment....	16.7°
Duration of experiment....13m. 50s.	13.83⅓ m.
Dynamometer at beginning (free)....	994.2
Dynamometer at end (free)....	995.
Mean dynamometer zero....	994.6
Speed of main shaft, beginning....	174 per min.
Speed of main shaft, end....	170
Mean	172
Mean reading of dynamometer during experiment...	771.75 lb.

(Varying from 760 to 781, 16 readings).

E. M. F. of current maintaining field was 61 divs. of galvanometer, on which 158 d. corresponded to 16 Daniell cells, *i. e.*, E. M. F. = $\frac{61}{168} \times 16 \times 1.079$ volts.

Energy expended on driving armature, as indicated by dynamometer = K (ft.) × 172 (rev.) × 13.833⅓ (min.) × $\left(\frac{994.6 - 771.75}{2}\right)$ =2,844,600 foot pounds.

Energy expended on field of force, $\frac{6}{5} \times \frac{45.25\text{ (ft. lb.)}}{1.47\text{ (ohms.)}} \times 13.883\text{(m.)} \times \left(\frac{61}{168} \times 16 \times 1.079\right)^2$ = 19,634 foot pounds.

Hence, total energy expended, 2,864,234 foot pounds.

Energy Realized.

a. In calorimeter $= 772 \times 172.77 \times 16.7° =$ .....2,227,420 ft. lb.
b. In leading wires $\frac{1}{300}$ of above.................... 7,425 ft. lb.
c. In armature $\frac{14}{172}$ of calorimeter.............. 181,302 ft. lb.

Hence,
Total energy realized..........................2,416,147
Total available $(a + b)$........................2,234,845

Hence,
Total efficiency................................ 84.5 per cent.
Total available................................ 78.2 per cent.

Remarks.

During this test the driving power was about 6¼ horse power; the electromotive force of the field current, 6.27 volts, giving a current through the magnet wires of about 4¼ webers; and the current developed by the machine was about 45.8 webers through a total resistance of 1.866 ohms.

SECOND TEST.

Total weight calorimeter and contents	200.00 lb.
Hence by preceding data, heat capacity =	175.27 water lb.
Temperature of air	71.1° to 71.8°
Initial temperature of water	63.2°
Terminal temperature of water	79.9°
Gain	16.7°
Duration of experiment	9 minutes.
Speed of main shaft, beginning	176 per m.
Speed of main shaft, middle	173 per m.
Speed of main shaft, end	177 per m.
Mean	175.33
Dynamometer reading before experiment	985
Dynamometer reading after experiment	995
Mean dynamometer zero	990

Mean reading of dynamometer during the experiment (9 readings, between 645 and 666)..............656

Electromotive force of field (by high resistance galvanometer) $= \frac{145}{168} \times 16 \times 1.079 =$ .... 14.901 volts.

E. M. F. of dynamo current $= \frac{240}{51} \times 20 \times 1.079 =$ ..101.55 volts.

E. M. F. of terminals of dynamo; current broken, $\frac{290}{51} \times 20 \times 1.079 =$ ....122.71 volts.

Energy Expended.

a. In driving armature according to dynamometer, $K \times 175\frac{1}{3}$ (rev.) $\times 9.0$ (m.) $\times \frac{990-656}{2} =$ ...2,827,550 ft. lb.

b. In maintenance of field of force, $\frac{6}{5} \times 44.25$ (ft. lb.) $\times 9$ (m.) $\times \frac{(14.901)^2}{1.47} =$ .... 72,180 ft. lb.

Hence,
Total energy expended........................2,899,730 ft. lb.

Energy Realized.

a. In calorimeter, $772 \times 175.27 \times 16.7° =$ ......2,259,700 ft. lb.
b. In leading wires $\frac{1}{300}$ of above................ 7,532 ft. lb.
c. In armature $\frac{0.14}{1.72}$ of *a*....................... 183,930 ft. lb.

Total energy realized $(a + b + c)$............2,451,162 ft. lb.
Available (outside of machine) $(a + b)$..........2,267,232 ft. lb.

Hence,
Total efficiency.............................. 84.5 per cent.
Available efficiency.......................... 78.2 per cent.

Remarks.

As a check we may compute the total efficiency from the galvanometer reading and the resistance: Energy developed, 44.25 (ft. lb.) $\times 9$ (m.) $\times 101.55$ (volts) $\times 1,866$ (ohms) $= 2,200,500$ ft. lb.

The discrepancy is fairly explained by the defective insulation of long wires leading to the galvanometer, as it was raining at the time.

During the experiment the driving power was about $9\frac{1}{4}$ horse power, and the current was 57.4 webers (according to galvanometer, 54.4).

Even with this current the spark at the commutator was very trifling.

SUMMARY.

	Total Efficiency.	Available Efficiency.
According to first test	84.5 p. c.	78.2 p. c.
According to second test	84.5 p. c.	78.2 p. c.

The Prony dynamometer is connected to the Edison dynamometer by a belt from the same countershaft, which is also belted to the electric generators. If we should assume the correctness of the Prony, and that the loss in the transmitting power between the Edison dynamometer and the arbor of the armature was only the same as between the two dynamometers, the above numbers would have to be increased in the ratio of 100 to 93.2 (see above), and we should have:

Total efficiency 90.7
Available efficiency 83.9

C. F. BRACKETT,
C. A. YOUNG.

PRINCETON, N. J., April 10, 1880.

THE ECONOMY OF THE EDISON DYNAMO-MACHINE.

EXTRACTS FROM A PAPER WRITTEN BY MR. JOHN W. HOWELL, OF THE STEVENS INSTITUTE OF TECHNOLOGY, REPORTING HIS TESTS ON THE EDISON DYNAMO ELECTRIC-MACHINE, LAMPS AND CONDUCTORS. PUBLISHED IN VAN NOSTRAND'S ENGINEERING MAGAZINE, JANUARY, 1882.

In writing this thesis I have endeavored to determine as nearly as I was able the cost of electric lighting by incandescence. Owing to the interest attached to the subject, and the lack of data upon which calculations can be based, I have endeavored to consider the subject in all its details, and have taken every precaution that suggested itself to guard against error.

The data given are sufficient to calculate the number of lamps to be obtained from each indicated horse-power in a steam engine; beyond this I have not attempted to go, as my experience is insufficient to enable me to make any further determinations.

EFFICIENCY OF THE GENERATOR.

The generator tested was one of the latest pattern devised by Mr. Edison.

In my experiments the field was excited by a current shunted from the main circuit, the relative resistances of the mains and magnet coils determining the amount of energy expended on the magnets, and consequently the intensity of the magnetization and the electromotive force of the generator.

APPARATUS FOR MEASUREMENT OF THE MECHANICAL ENERGY TRANSMITTED TO THE GENERATOR.

In measuring the energy transmitted to the generator, the dynamometer built by the class of '79 was used. This was carefully standardized by supporting the pendulum in a horizontal position at a point 2 feet from the axis of the shaft, and weighing the pressure of the support upon a platform scale; the weight of the pendulum and support was 183.25; the weight of the support was 12.1; the weight of the pendulum was 171.2 lbs.

This gives us the force acting at the circumference of a pulley of 1 foot radius by multiplying 171.2 by the sine of the angle of deflection. This is a measure of the force transmitted through the gear at the top of the pendulum, and includes, beside the force required to turn the armature in the field of force, the force necessary to overcome the friction of the dynamometer bearing, and also the

friction of the armature shaft in its bearings. In order to determine what part of the transmitted energy was lost in overcoming friction, a Prony brake was applied to the pulley of the armature, close beside the belt, while the generator was running. Removing the brushes, to be sure no current was generated, we tightened the brake until the pendulum showed the same deflection that it did during the test; we thus made a direct substitution of the Prony brake for the retarding action of the lines of magnetic force upon the armature when the circuit was closed, and the force exerted by the arm of the brake, upon a platform scale reduced to the radius of the pulley, will be the force required to turn the armature in the field of force. Instead of measuring the pressure exerted by one arm of the brake upon a scale, we measured the lifting effort exerted by the other end upon a weight resting upon the scale. We placed a light counterweight upon the other end of the brake, to make the zero reading more definite, and in getting the zero we raised the counterweighted end, and let it down gently, rapping the center of the brake to prevent sticking.

Several readings fixed the zero between 35½ and 35. Running at about the same speed as in the test, and tightening the brake until we got a deflection of 42°, we made several readings on the scale, which varied from 19 to 20½. Using the highest zero reading and the lowest running reading, we get a force of 16½ lbs. acting at a distance of 2 feet from the center of the shaft; this reduced to the radius of the armature pulley gives $16\frac{1}{2}\times\frac{24}{5}=79.2$ for the force acting at the circumference of the armature pulley. If no friction had intervened this force would have been

$$\frac{171.2\times(\text{sine } 42^\circ=66.913)}{125}=91.644 \text{ lbs.},$$

showing a loss of 91.644—79.2=12.444 lbs., or 13½ per cent. of the power transmitted.

This loss of 13½ per cent. is caused by the friction of the dynamometer and the friction of the armature bearings. To get the force actually applied at the circumference of the pulley on the armature shaft, we must determine the friction of the dynamometer bearing alone. To do this we made a wooden brake of the same diameter as the driving pulley on the dynamometer that could run on a 10-inch pulley on the dynamometer shaft, we then clamped the Prony brake upon the dynamo pulley, and also clamped the belt on the dynamo pulley and passed it over the wooden brake. Running under these conditions and tightening the wooden brake on the 10-inch pulley until the pendulum showed a deflection of 42°, we measured the force acting at the circumference of the dynamo pulley and also at the circumference of the dynamometer pulley by the lifting effort of the Prony brake upon the weight on the scale. The object of this arrangement of brakes was to get the friction under the same conditions as those under which we ran the test. To get the zero reading in this case we clamped the Prony on the dynamo pulley, and loosened the wooden brake and counterweighted the other arm of the Prony brake, until the armature turned in its bearings; then letting it come to rest and rapping the bearings of the dynamo and dynamometer, we determined the zero reading to be 33 lbs. Several readings fixed the readings for 42° at 16 lbs., therefore the force acting at the circumference of the dynamo pulley was $(33-16)\times\frac{24}{5}=81.6$, showing a loss of 91.644—81.6=10.044 lbs., or 10.9 per cent. of the total energy transmitted.

Apparatus for the Measurement of Electrical Energy.

The resistance over which the generator worked consisted of three strands of iron wire in multiple arc, each of which was .104″ in diameter. These were stretched from one gallery of the shop to the other in the open air.

In measuring the resistance of the different parts of the circuit wires were led from the binding posts of the generator to the Wheatstone bridge, then by breaking the connection with the armature and

magnet coils, we could measure the resistance of the line, or by breaking the connections with the line and magnets we could measure the resistance of the armature and leaders, or by breaking the connections with the armature and the line we could measure the resistance of the magnet coils.

The electrical energy developed in the circuit was determined by three methods:

1st. By a voltameter, or a copper-depositing cell.
2d. By a calorimeter.
3d. By measuring the electro-motive force and resistance.

First Method.

The voltameter consisted of a glass jar large enough to hold six plates of copper, 7″×8″.

These were placed $\frac{1}{4}$″ apart, and held in place by a light wooden frame. They were connected alternately to the positive and negative wires from the generator. This method of arranging the plates brings both sides into action, gives a large area of plate, and makes the resistance of the cell very low and the consequent heating very little. By means of mercury connections the voltameter could be thrown into or out of circuit instantly without breaking the current, and the leaders were so proportioned that throwing it in and out did not alter the resistance of the circuit.

In calculating the current from the weight of copper carried from one set of plates to the other, the weight gained by the negative plates was considered as the weight carried over, and the constant .32456, given by Sprague (Jenkin gives .324) for the amount of copper in milligrams carried over in one second by a current of one Weber. Before making the test, the current was passed through the voltameter for some time, in a direction opposite to that in which it was passed during the test, to insure that the copper carried over during the test was copper that had been deposited before, otherwise energy may be lost in separating the copper from the positive plate.

Second Method.

In determining the electrical energy by the second method, a calorimeter was used which consisted of a cylindrical vessel of galvanized iron encased in a wooden jacket, and so supported as to leave an air space of about $\frac{1}{4}$ an inch on all sides between the calorimeter and the jacket. This prevented any great conduction of heat from the calorimeter to external objects; still some heat must be wasted in heating the calorimeter and the surface it rests upon.

To determine the amount of heat thus wasted 55 lbs. of water were put in the calorimeter, and its temperature carefully determined it was 19.85°C. A large pail of water was then heated to 54.3°C, and 18$\frac{3}{4}$ lbs. were poured into the calorimeter. This made the weight of water in the calorimeter about the same as was used in the test, and the same part of the calorimeter was heated in each case, the final temperature of the water being 28.50°C, the range of temperature used in the test was included in this range. The heat contained in the water poured into the calorimeter may be represented by $18.75 \times 26.2 = 491.25$. Of this $55 \times 8.65 = 475.75$ went to raise the temperature of the water in the calorimeter, and the remainder 155 must have been imparted to the calorimeter. As the range of temperature in the calorimeter was 8.65°, 1.78 of these units were required to raise the temperature 1°, or the same amount of heat was used in heating the calorimeter as would be required to raise 1.78 lbs. of water through the same range of temperature; therefore the proper correction may be applied by adding 1.78 lbs. to the weight of water in the calorimeter.

To measure the heating effect of the current, a coil of copper wire was put into the calorimeter, the resistance of which was ex-

actly .1$\frac{1}{10}$ Ohm. at 74°F. The chief source of error in a calorimeter test of this kind is the tendency of the current to pass from one part of the wire to another through the water, instead of passing through the wire. This in itself is not a source of error if we measure the resistance of the coil in the water, but in so passing, it may carry metal from one part of the wire to another, and the energy so used cannot be calculated, and is lost; to obviate this difficulty distilled water was used, the resistance of which is much higher than ordinary water. The resistance of the coil measured in the water did not differ perceptibly from its resistance in the air, and at the close of the test no evidence of copper having been carried from one part to the other was discernible. To determine the range of temperature during the test, a Fahrenheit thermometer was used that was graduated to fifths of degrees, but the graduation was so plain that twentieths of a degree could easily be read. In order to be certain that the temperature of the water was uniform throughout a pump was placed in the center of the calorimeter, which consisted simply of a copper tube about 1$\frac{3}{4}$″ in diameter, its bottom was $\frac{1}{2}$″ above the bottom of the calorimeter and contained a valve opening downward; the piston also carried a valve opening downward. The water in the calorimeter covered the top of the tube, and by this means the water was taken from the surface when it is warmest, and carried to the bottom, where it is coldest. The circulation thus obtained was very perfect, as shown by some ink drops put in the pump barrel.

Third Method.

In determining the electrical energy by the third method, the electro-motive force was measured between the binding posts of the generator, by means of a Thomson high-resistance galvanometer. As a standard of electro-motive force, Latimer Clark cells were used, four of which were made up new for the purpose. These agreed with each other very closely, and in using them they were connected in series, thus getting their combined effect, and averaging their errors.

In using them they were allowed to charge a condenser, and the condenser was then discharged through the galvanometer.

The deflection produced is an accurate measure of the current flowing through the galvanometer and consequently of the charge held by the condenser, which depends upon the electro-motive force of the terminals connected with the condenser. To connect the condenser alternately with the cells and the galvanometer, a simple switch was used by which the change could be made instantly. In making the test part of the condenser of .2$\frac{2}{10}$ microfarad capacity wire used and four standard cells in series. The damping magnet of the galvanometer was then adjusted until the discharge of the condenser produced a deflection of 291 divisions, as the electro-motive force of the cell is 1,456 volts and four in series were used, the deflection corresponding to one volt was $\frac{291}{1.456\times4}=50$. The instrument being standardized in this way, the liability to error was very small; in use, however, $\frac{9}{10}$ of the current was shunted from the galvanometer, only allowing $\frac{1}{10}$ to pass through, thus getting five deflections to a volt.

The ends of all wires dipping into mercury were amalgamated with mercurous nitrate, which made the connections very perfect.

In measuring the resistances of the armature and of the armature and leaders, the Wheatstone's bridge was used, and Thomson's reflecting galvanometer in place of the small galvanometer usually employed. The resistance of the armature mains and leaders was between .17 and .18 Ohm. When the bridge indicated .17 the galvanometer showed a deflection of 29.5 divisions; when it indicated .18 the galvanometer showed an opposite deflection of 45. From this we get the resistance of the armature mains and leaders, .17395 Ohm.

The main alone measured .14460, leaving for the resistance of the armature and leaders to the binding parts .029 Ohm.

Leading wires being clamped on the commutator the resistance measured in several positions was .16207. These leaders measured .14604, leaving for the resistance of the armature alone .016 Ohm.

The resistance of the field magnet coils was 37 Ohms.

Test by Voltameter.

Before making the test the generator was run for some time to allow the circuit to heat up, and the resistance of the line measured from time to time until it was found to remain constant. The voltameter was then introduced into the circuit and allowed to remain fifteen minutes.

During this time the speed of the dynamometer was determined for ten minutes, and the average speed computed.

The deflection of the pendulum was observed every three minutes and the average taken, although the variation was only one degree. At the end of the test the circuit was broken and the resistance again measured, and it was found not to have changed perceptibly.

The plates were then removed, washed in water, then in alcohol, and dried in a gentle heat. They were then weighed carefully.

Data obtained from the Test.

Weight of copper gained by negative plates = 24,465 m. g.

Time of test = 15 minutes.

Weight gained per second = 27,183 m. g.

Average speed of dynamometer = 400.5 rev. per min.

Average deflection of pendulum = 42° 20′.

Resistance of iron wire = .76 Ohm.

Resistance of iron wires and magnet coils in multiple arc = .744 Ohm.

Total resistance of circuit = .744 + .029 = .773 Ohm.

Internal resistance of armature = .016 Ohm.

Results obtained from Data.

Value of current in webers $=\frac{27.183}{.32456}=83.753$.

Electrical energy $(83.753)^2 \times .773 \times 44.24 = 239880.726$ ft. lbs. per minute.

Energy indicated by dynamometer $171.2 \times$ (sin. $42° = .67344) \times 4505 \times 6.2832 = 290125.54$ ft. lbs. per minute.

Friction of dynamometer and generator $290125.54 \times .135 = 39166.9479$ ft. lbs. per minute.

Energy used in turning armature in field of force $290125.54 \times 855 = 250958.59$ ft. lbs. per minute.

Friction of dynamometer alone $= 290125.5 \times .109 = 31623.68$ ft. lbs. per minute.

Energy actually applied to armature pulley $290125.54 \times .891 = 258501.96$ ft. lbs. per min.

Of the total electrical energy $239880.7 \frac{.016}{.773} = 4965.189$ appeared in the armature, $\frac{.744}{.773 \times 49.68} \times 239880.726 = 4647.39$ in the magnet coils, and 230268.176 ft. lbs. per minute in the external circuit.

The efficiency of the generator is the ratio of the energy required to turn the armature in the magnetic field, to the total electrical energy developed $=\frac{239880.726}{250958.59}=.955$.

The commercial efficiency is the ratio of the energy required to drive the machine (including friction) to the electrical energy which appears in the external circuit $=\frac{230268.169}{258501.96}=.8608$.

Test by means of the Calorimeter.

As in the voltametric test the generator was first run until the circuit was thoroughly heated, and the same care was taken to determine the speed and deflection of the dynamometer. When the

calorimeter was thrown into the circuit an approximately equal resistance was thrown out so as not to change the total resistance too much. At the end of the test the resistance of the circuit was measured carefully as soon as the circuit was broken and before the wires became cooled.

Data obtained from this Test.

Water in calorimeter = 77 lbs.
Connection for waste heat = 1.78 lbs.
Range of temperature = 79° — 69.8° = 9.2°F.
Specific heat for this range = 1.0015.
Average speed of dynamometer = 394 rev. per min.
Average deflection of pendulum = 43° 24′ (sin = .68709).
Time of tests = 16 minutes.
Resistance of iron wires and calorimeter coil = .68 Ohm.
This and magnet coil in multiple arc = .667 Ohm.
Total resistance of circuit .667 + .029 = .696.
Resistance of calorimeter coil = .1 Ohm.

Results obtained from these Data.

Energy developed in calorimeter $= \frac{78118 \times 1.0015 \times 9.2 \times 772}{16} =$ 35022.897 ft. lbs. per minute.

Total electrical energy $35022.897 \times 6.96 = 243759.36$ ft. bs. per minute.

Energy indicated by dynamometer $= 171.2 \times .68709 \times 394 \times 6.2832 = 291201.46$ ft. lbs. per min.

Energy used in turning armature in field of force $291201.46 \times .865 = 251889.265$ ft. lbs. per min.

Energy actually applied to armature pulley $291201.46 \times .891 = 259460.5$ ft. lbs. per min.

Of the electrical energy $243759.36 \times \frac{.016}{.696} = 5603.66$ appeared in the armature $243759.36 \times \frac{.667}{.669 \times 54.41} = 4215.89$ in the magnet coils; and 233939.81 ft. lbs. per minute appeared outside.

Efficiency $= \frac{243759.363}{251889.265} = .967$.

Commercial efficiency $= \frac{233939.81}{259460.5} = .901$.

Test by Measurement of the Electro-Motive Force and Resistance.

In this test the electro-motive force was measured between the binding posts of the generator, and the external resistance was measured between the same points.

The deflection and speed of the dynamometer were measured at the same time, the electro-motive force was observed and the resistance was measured just before and after these observations and was the same in both cases.

Data obtained from this Test.

Electro-motive force = 53 volts.
Resistance of circuit (external) .64 Ohm.
Resistance between binding posts .629.
Average speed of dynamometer, 355 rev. per min.
Average deflection, 42° (nat. sine = .66913).
Total resistance of circuit, .658.

Results obtained from these Data.

Energy developed in external circuit $\frac{(53^2)}{629}\times 44.24=197567.43$ ft. lbs. per min.

Total electrical energy $197567.43\times\frac{.658}{.629}=206673.0295$ ft. lbs. per min.

Energy in armature $206673.029\times\frac{.016}{.658}=5025.5$.

Energy in magnet coils $\frac{(53^2)}{37}\times 44.24=3346.667$ ft. lbs. per min.

Energy in external circuit 198300.88 ft. lbs. per min.

Energy indicated by dynamometer $171.2\times .66913\times 355\times 62332=2553+9.04$ ft. lbs. per min.

Energy used in turning armature in field of force $255519.04\times .865=221023.97$ ft. lbs. per min.

Energy actually applied to armature pulley $255519.04\times .891=227667.47$ ft. lbs. per min.

$$\text{Efficiency}=\frac{206673.0295}{221023.97}=.935.$$

$$\text{Commercial efficiency}=\frac{198300.88}{227667.47}=.87.$$

Average efficiency, .951.

Average commercial efficiency, .887.

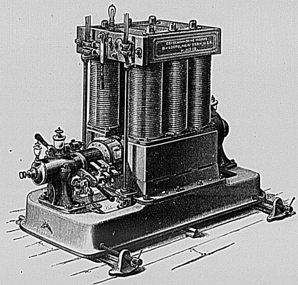
It will, therefore, be seen from the above tests, that as long ago as January, 1882, the Edison machine converted into electrical energy 95 per cent. of the indicated horse-power expended, and that 88 per cent. of such horse-power was converted into actual light. Since the above tests, however, further improvements have been made which show even a still higher efficiency.

[NOT FILMED: PAGES 33-52 (TESTIMONIALS); PAGES 53-59 (LIST OF EDISON ISOLATED PLANTS). THESE ITEMS ALSO APPEAR IN THE EDISON ELECTRIC LIGHT CO. BULLETINS.]

FLOOR SPACE:
77×33 INCHES.

HEIGHT:
5 FEET 1 INCH.

WEIGHT:
7,600 POUNDS.



PULLEY:
FACE, 12½ INCHES.
DIAMETER, 14 INCHES.

REVOLUTIONS:
1,100 PER MINUTE.

65 HORSE POWER.

THE EDISON "H" DYNAMO

FOR 400 LIGHTS OF 16 CANDLE POWER EACH.

PRICE LIST.

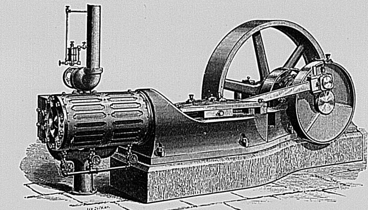
25 Lamp Dynamo....	$450 00	200 Lamp Dynamo....	$2,400 00
50 " "	750 00	300 " "	3,450 00
100 " "	1,350 00	400 " "	4,500 00

These prices include a full complement of lamps and sockets, together with a hand regulator for controlling the candle power of the lamps in circuit.

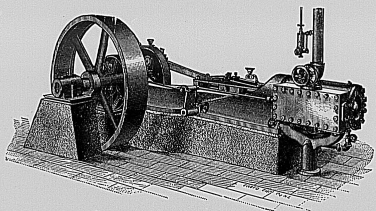
The price of fixtures varies according to style and finish. For common factory use, however, their cost would probably not exceed 75 cents per lamp. A catalogue showing the various styles of fixtures made for the Edison lamp, together with the prices of same, will be found at the end of this book.

The remaining item entering into the cost of a plant is the wiring, which in a plant up to 300 lamps capacity will average $5 per lamp, and in larger plants $4.75 per lamp, exclusive of the travelling expenses and board of the workmen.

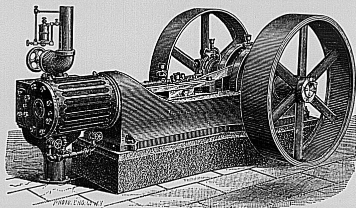
ENGINES.



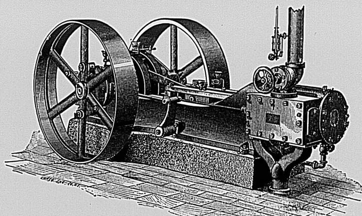
Armington & Sims Single-Disc Engine.



Armington & Sims Single-Disc Engine.



ARMINGTON & SIMS DOUBLE-DISC ENGINE.



ARMINGTON & SIMS DOUBLE-DISC ENGINE.

TABLE SHOWING DIMENSIONS, POWERS, AND SPEEDS.

	Cylinders.		Speed.		Indicated Horse-Powers.	Fly-Wheels.		Driving Belts.		Size of Quadrangle within which Engine will Stand, Including Fly-Wheel.			
	Diameter.	Length of Stroke.	Revolutions of Crank per Minute.	Velocity of Piston. Feet per Minute.	Without Condensation.	Diameter.	Width of Face.	Velocity in Feet per Minute.	Width for Non-condensing Engines.	Length.		Width.	
	In.	In.				Inches.	Inches.		Inches.	ft.	in.	ft.	in.
SINGLE ENGINES.	* 6.5	8	350	466	19	34	5.5	3120	5 & 5	7	0	3	2
	* 8.5	10	300	500	35	40	8.5	3120	8 & 6	7	6	4	0
	* 9.5	12	275	550	48	47	10.5	3370	10 & 8	9	3	4	6
	*13.	13	275	600	98	60	13	4300	12 double.	10	10	5	0
	*14.5	13	275	600	123	60	13	4300	12 "	11	0	5	0
	12.5	12	300	600	92	60	13	4700	12 "	10	6	6	0
	12.5	20	180	600	92	72	14	3390	13 "	13	6	7	10
	14.5	24	150	600	124	78	20	3000	18 "	15	6	8	6
	16.5	24	150	600	160	84	24	3300	22 "	16	3	9	7
	18.5	30	120	600	200	108	28	3400	26 "	19	6	10	6
	20.	30	120	600	236	120	30	3770	28 "	24	0	12	6
DOUBLE ENGINES.	12.5	20	180	600	184	84	22	3960	20 double.	14	9	9	0
	14.5	24	150	600	248	96	30	3770	28 "	16	3	10	0
	16.5	24	150	600	320	108	26	4200	24 treble.	17	3	11	4
	18.5	30	120	600	400	120	34	3770	32 "	20	0	13	0
	20.	30	120	600	472	132	36	4140	34 "	25	0	14	6

The sizes marked * have two balance-wheels; all others are of style shown on title page.

The indicated horse-powers are those given by an initial pressure of 80 lbs. on the square inch, cut off at one-quarter of the stroke. The engines are adapted to work under the highest pressures, if required. By the use of suitable condensing apparatus, the power of these engines can be increased twenty-five per cent. Where engines are used condensing, a wider-faced wheel, adapted to the belts required, will be furnished. The strain on belting is computed at the rate of thirty-five pounds for each inch in width of single leather belting.

Indicated Horse-Power at Different Initial Pressures of Steam.

CUTTING OFF AT .25 OF A STROKE.

Initial Pressure.	6.5x8.				8.5x10.					9.5x12.					Initial Pressure.
	300 Rev.	325 Rev.	350 Rev.	375 Rev.	225 Rev.	250 Rev.	275 Rev.	300 Rev.	325 Rev.	200 Rev.	225 Rev.	250 Rev.	275 Rev.	300 Rev.	
50	9.3	10.0	10.8	11.6	14.9	16.6	18.2	19.9	21.6	19.9	22.4	24.9	27.4	29.9	50
55	10.5	11.3	12.2	13.1	16.9	18.7	20.6	22.5	24.4	22.5	25.3	28.1	30.9	33.7	55
60	11.7	12.6	13.6	14.6	18.8	20.9	23.0	25.1	27.2	25.1	28.2	31.4	34.3	37.6	60
65	12.9	13.9	15.0	16.1	20.8	23.0	25.4	27.7	30.0	27.7	31.1	34.6	37.9	41.5	65
70	14.1	15.2	16.4	17.6	22.7	25.2	27.7	30.3	32.8	30.3	34.0	37.9	41.5	45.4	70
75	15.3	16.5	17.8	19.1	24.7	27.3	30.1	32.9	35.6	32.9	36.9	41.1	45.1	49.3	75
80	16.5	17.8	19.2	20.6	26.6	29.4	32.5	35.4	38.4	35.4	39.8	44.3	48.7	53.1	80
85	17.7	19.1	20.6	22.1	28.6	31.6	34.9	38.0	41.2	38.0	42.7	47.6	52.3	57.0	85
90	18.9	20.4	22.0	23.6	30.5	33.7	37.2	40.6	44.0	40.6	45.6	50.8	55.8	60.9	90
95	20.1	21.7	23.4	25.1	32.5	35.9	39.6	43.2	46.9	43.2	48.5	54.0	59.4	64.8	95
100	21.3	23.0	24.8	26.6	34.4	38.1	42.0	45.8	49.7	45.8	51.5	57.3	63.0	68.7	100

Initial Pressure.	12.5x12.					13x13.				14.5x13.					Initial Pressure.
	200 Rev.	225 Rev.	250 Rev.	275 Rev.	300 Rev.	200 Rev.	225 Rev.	250 Rev.	275 Rev.	225 Rev.	250 Rev.	275 Rev.	300 Rev.	350 Rev.	
50	34.4	38.7	43.0	47.3	51.6	40.2	45.3	50.3	55.7	56.4	62.8	69.6	75.3	87.9	50
55	38.8	43.7	48.6	53.4	58.3	45.4	51.1	56.9	63.0	63.8	71.0	78.6	85.1	99.3	55
60	43.3	48.8	54.2	59.6	65.0	50.7	57.0	62.5	69.3	71.2	79.2	87.7	95.0	110.8	60
65	47.7	53.8	59.8	65.7	71.7	55.9	62.9	69.2	76.7	78.6	87.4	96.7	104.8	122.2	65
70	52.2	58.8	65.4	71.9	78.4	61.2	68.8	75.8	84.0	86.0	95.6	105.8	114.6	133.7	70
75	56.6	63.8	71.0	78.0	85.1	66.4	74.7	82.5	91.4	93.3	103.8	114.8	124.4	145.1	75
80	61.1	68.9	76.6	84.2	91.8	71.7	80.6	89.2	98.8	100.7	112.0	123.9	134.3	156.6	80
85	65.5	73.9	82.2	90.3	98.6	76.9	86.5	95.8	106.2	108.0	120.2	132.9	144.1	168.0	85
90	70.0	79.0	87.8	96.5	105.4	82.1	92.4	102.5	113.6	115.4	128.3	142.0	153.9	179.5	90
95	74.5	84.0	93.4	102.7	112.1	87.4	98.3	109.2	121.0	122.7	136.5	151.1	163.7	190.9	95
100	79.2	89.1	99.0	108.9	118.8	92.6	104.2	115.9	128.4	130.0	144.7	160.2	173.5	202.3	100

INDICATED HORSE-POWER AT DIFFERENT INITIAL PRESSURES OF STEAM.
CUTTING OFF AT .25 OF A STROKE.

INITIAL PRESSURE.	12.5x20. 180 REVOLUTIONS.	14.5x24. 150 REVOLUTIONS.	16.5x24. 150 REVOLUTIONS.	18.5x30. 120 REVOLUTIONS.	20x30. 120 REVOLUTIONS.	INITIAL PRESSURE.
50	51.6	69.5	89.7	112.8	132.4	50
55	58.3	78.5	101.4	127.4	149.6	55
60	65.0	87.6	113.1	142.1	166.9	60
65	71.7	96.6	124.8	156.8	184.2	65
70	78.4	105.7	136.5	171.5	201.5	70
75	85.1	114.7	148.2	186.2	218.8	75
80	91.8	123.8	159.9	200.9	236.1	80
85	98.6	132.8	171.6	215.6	253.3	85
90	105.4	141.9	183.3	230.3	270.5	90
95	112.1	150.9	195.0	245.0	287.7	95
100	118.8	160.0	206.7	259.7	304.9	100

It should be noted that these figures are the *indicated* H. P.: for the *effective* power, allowance should be made for the friction of the engine. Also, that the steam pressure is the *initial pressure upon the piston:* to obtain this pressure it is often necessary to carry a much higher boiler pressure if the engine is located at a distance and the steam pipe is too small or crooked; allowance should be made for all this. It is very desirable that the steam pipe should be ample in size, and as short and direct as possible, to obtain the best result.

Engines will be furnished for speed noted, and the Automatic Cut-off Regulator is so constructed that a variation can be made either way within moderate limits, but not to the extreme limits given in the tables; it is, therefore, necessary that about the speed at which the engine is required to be run should be stated. Unless otherwise ordered, the engines will be sent with the regulator adapted to the following speeds: 6.5 x 8, 350 Rev.; 8.5 x 10, 300 Rev.; 9.5 x 12, 275 Rev.; 12.5 x 12, 300 Rev., and 13 & 14.5 x 13, at 275 revolutions per minute, these being the speeds that we recommend.

It will be noted that we give but one speed for each size of the single-wheel engine. We do not recommend other speed than this, but the regulators are adapted to variation ten per cent. either way, if occasion requires.

TABLE OF DECIMAL EQUIVALENTS OF 8THS, 16THS, 32DS, AND 64THS OF AN INCH.

EIGHTHS.	*SIXTEENTHS.*	*THIRTY-SECONDS.*		*SIXTY-FOURTHS.*			
$\frac{1}{8}$ = .125	$\frac{1}{16}$ = .0625	$\frac{1}{32}$ = .03125	$\frac{17}{32}$ = .53125	$\frac{1}{64}$ = .015625	$\frac{17}{64}$ = .265625	$\frac{33}{64}$ = .515625	$\frac{49}{64}$ = .765625
$\frac{1}{4}$ = .25	$\frac{3}{16}$ = .1875	$\frac{3}{32}$ = .09375	$\frac{19}{32}$ = .59375	$\frac{3}{64}$ = .046875	$\frac{19}{64}$ = .296875	$\frac{35}{64}$ = .546875	$\frac{51}{64}$ = .796875
$\frac{3}{8}$ = .375	$\frac{5}{16}$ = .3125	$\frac{5}{32}$ = .15625	$\frac{21}{32}$ = .65625	$\frac{5}{64}$ = .078125	$\frac{21}{64}$ = .328125	$\frac{37}{64}$ = .578125	$\frac{53}{64}$ = .828125
$\frac{1}{2}$ = .50	$\frac{7}{16}$ = .4375	$\frac{7}{32}$ = .21875	$\frac{23}{32}$ = .71875	$\frac{7}{64}$ = .109375	$\frac{23}{64}$ = .359375	$\frac{39}{64}$ = .609375	$\frac{55}{64}$ = .859375
$\frac{5}{8}$ = .625	$\frac{9}{16}$ = .5625	$\frac{9}{32}$ = .28125	$\frac{25}{32}$ = .78125	$\frac{9}{64}$ = .140625	$\frac{25}{64}$ = .390625	$\frac{41}{64}$ = .640625	$\frac{57}{64}$ = .890625
$\frac{3}{4}$ = .75	$\frac{11}{16}$ = .6875	$\frac{11}{32}$ = .34375	$\frac{27}{32}$ = .84375	$\frac{11}{64}$ = .171875	$\frac{27}{64}$ = .421875	$\frac{43}{64}$ = .671875	$\frac{59}{64}$ = .921875
$\frac{7}{8}$ = .875	$\frac{13}{16}$ = .8125	$\frac{13}{32}$ = .40625	$\frac{29}{32}$ = .90625	$\frac{13}{64}$ = .203125	$\frac{29}{64}$ = .453125	$\frac{45}{64}$ = .703125	$\frac{61}{64}$ = .953125
	$\frac{15}{16}$ = .9375	$\frac{15}{32}$ = .46875	$\frac{31}{32}$ = .96875	$\frac{15}{64}$ = .234375	$\frac{31}{64}$ = .484375	$\frac{47}{64}$ = .734375	$\frac{63}{64}$ = .984375

"CONSTANTS" OF THE ARMINGTON & SIMS ENGINES,

AT DIFFERENT SPEEDS.

SIZE OF ENGINE.	120 REV.	150 REV.	180 REV.	200 REV.	225 REV.	250 REV.	275 REV.	300 REV.	325 REV.	350 REV.	375 REV.
6.5 x 8						.3283	.3619	.3947	.4276	.4606	.4934
8.5 x 10					.6363	.7071	.7777	.8484	.9191	.9900	
9.5 x 12				.8484	.9545	1.0606	1.1666	1.2727	1.3787		
12.5 x 12			1.3200	1.4666	1.6500	1.8333	2.0166	2.2000	2.3833		
13. x 13			1.5451	1.7166	1.9313	2.1459	2.3605	2.5751	2.7897		
14.5 x 13			1.9279	2.1419	2.4098	2.6777	2.9452	3.2131	3.4811		
12.5 x 20		1.8333	2.2000	2.4442	2.7500						
14.5 x 24	2.3728	2.9660	3.5592								
16.5 x 24	3.0779	3.8474	4.6169								
18.5 x 30	4.8309	6.0386									
20 x 30	5.6545	7.0681									

Multiply the Constant opposite the Engine Speed, by the M. E. P. of the Indicator Card, and the product is the H. P.

AREAS OF CIRCLES IN SQUARE INCHES.

Diameter in Inches.	Area in Sq. Inches.	Diameter in Inches.	Area in Sq. Inches.	Diameter in Inches.	Area in Square Inches.	Diameter in Inches.	Area in Sq. Inches.	Diameter in Inches.	Area in Sq. Inches.	Diameter in Inches.	Area in Sq. Inches.	Diameter in Inches.	Area in Sq. Inches.
$\frac{1}{16}$	.0031	$1\frac{9}{16}$	1.9175	$3\frac{1}{16}$	7.3662	6.25	30.67	12.25	117.86	18.25	261.59	24.25	461.86
$\frac{1}{8}$	.0123	$1\frac{5}{8}$	2.0739	$3\frac{1}{8}$	7.6699	6.5	33.17	12.5	122.72	18.5	268.80	24.5	471.44
$\frac{3}{16}$	.0276	$1\frac{11}{16}$	2.2365	$3\frac{3}{16}$	7.9798	6.75	35.78	12.75	127.68	18.75	276.12	24.75	481.11
$\frac{1}{4}$	.0491	$1\frac{3}{4}$	2.4053	$3\frac{1}{4}$	8.2958	7.	38.48	13.	132.73	19.	283.53	25.	490.87
$\frac{5}{16}$	.0767	$1\frac{13}{16}$	2.5802	$3\frac{5}{16}$	8.6179	7.25	41.28	13.25	137.89	19.25	291.04	25.25	500.74
$\frac{3}{8}$	.1104	$1\frac{7}{8}$	2.7612	$3\frac{3}{8}$	8.9462	7.5	44.17	13.5	143.14	19.5	298.65	25.5	510.71
$\frac{7}{16}$	.1503	$1\frac{15}{16}$	2.9483	$3\frac{7}{16}$	9.2806	7.75	47.17	13.75	148.49	19.75	306.36	25.75	520.77
$\frac{1}{2}$	.1963	2	3.1416	$3\frac{1}{2}$	9.6211	8.	50.26	14.	153.94	20.	314.16	26.	530.93
$\frac{9}{16}$	.2485	$2\frac{1}{16}$	3.3410	$3\frac{9}{16}$	9.9678	8.25	53.45	14.25	159.49	20.25	322.06	26.25	541.91
$\frac{5}{8}$	.3068	$2\frac{1}{8}$	3.5466	$3\frac{5}{8}$	10.321	8.5	56.74	14.5	165.13	20.5	330.06	26.5	551.55
$\frac{11}{16}$	.3712	$2\frac{3}{16}$	3.7583	$3\frac{11}{16}$	10.680	8.75	60.13	14.75	170.87	20.75	338.16	26.75	562.00
$\frac{3}{4}$	.4418	$2\frac{1}{4}$	3.9761	$3\frac{3}{4}$	11.045	9.	63.61	15.	176.71	21.	346.36	27.	572.56
$\frac{13}{16}$	.5185	$2\frac{5}{16}$	4.2001	$3\frac{13}{16}$	11.416	9.25	67.19	15.25	182.65	21.25	354.66	27.25	583.21
$\frac{7}{8}$	.6013	$2\frac{3}{8}$	4.4301	$3\frac{7}{8}$	11.793	9.5	70.88	15.5	188.69	21.5	363.05	27.5	593.96
$\frac{15}{16}$	.6903	$2\frac{7}{16}$	4.6664	$3\frac{15}{16}$	12.177	9.75	74.66	15.75	194.83	21.75	371.54	27.75	604.81
1	.7854	$2\frac{1}{2}$	4.9087	4.	12.56	10.	78.54	16.	201.06	22.	380.13	28.	615.75
$1\frac{1}{16}$	.8866	$2\frac{9}{16}$	5.1573	4.25	14.18	10.25	82.51	16.25	207.39	22.25	388.82	28.25	626.80
$1\frac{1}{8}$	.9940	$2\frac{5}{8}$	5.4119	4.5	15.90	10.5	86.59	16.5	213.83	22.5	397.61	28.5	637.94
$1\frac{3}{16}$	1.1075	$2\frac{11}{16}$	5.6727	4.75	17.71	10.75	90.76	16.75	220.35	22.75	406.49	28.75	649.18
$1\frac{1}{4}$	1.2272	$2\frac{3}{4}$	5.9396	5.	19.63	11.	95.03	17.	226.98	23.	415.48	29.	660.52
$1\frac{5}{16}$	1.3530	$2\frac{13}{16}$	6.2126	5.25	21.64	11.25	99.40	17.25	233.71	23.25	424.56	29.25	671.96
$1\frac{3}{8}$	1.4849	$2\frac{7}{8}$	6.4918	5.5	23.75	11.5	103.86	17.5	240.53	23.5	433.74	29.5	683.49
$1\frac{7}{16}$	1.6230	$2\frac{15}{16}$	6.7772	5.75	25.96	11.75	108.38	17.75	247.45	23.75	443.01	29.75	695.13
$1\frac{1}{2}$	1.7671	3	7.0686	6.	28.27	12.	113.10	18.	254.47	24.	452.39	30.	706.86

RULE.—Square the diameter in inches and multiply by .7854.

FOR TABLE OF DECIMAL EQUIVALENTS SEE NEXT PAGE.

M. E. P. WITH 60 INDICATOR SPRING.

LENGTH. In.	.1	.2	.3	.4	.5	.6	.7	.8	.9
2.75	2.1818	4.3636	6.5454	8.7272	10.9091	13.0909	15.2727	17.4545	19.6363
2.80	2.1429	4.2857	6.4286	8.5714	10.7143	12.8571	15.0000	17.1428	19.2857
2.85	2.1053	4.2105	6.3158	8.4210	10.5263	12.6316	14.7368	16.8421	18.9473
2.90	2.0690	4.1379	6.2069	8.2758	10.3448	12.4138	14.4827	16.5517	18.6206
2.95	2.0339	4.0680	6.1017	8.1360	10.1695	12.2033	14.2372	16.2719	18.3050
3.00	2.0000	4.0000	6.0000	8.0000	10.0000	12.0000	14.0000	16.0000	18.0000
3.05	1.9672	3.9344	5.9016	7.8688	9.8361	11.8033	13.7705	15.7377	17.7049
3.10	1.9355	3.8710	5.8064	7.7419	9.6774	11.6129	13.5484	15.4838	17.4193
3.15	1.9048	3.8095	5.7143	7.6190	9.5238	11.4286	13.3333	15.2381	17.1428
3.20	1.8750	3.7500	5.6250	7.5000	9.3750	11.2500	13.1250	15.0000	16.8750
3.25	1.8462	3.6923	5.5384	7.3846	9.2308	11.0769	12.9231	14.7692	16.6154
3.30	1.8182	3.6364	5.4545	7.2727	9.0909	10.9091	12.7273	14.5454	16.3636
3.35	1.7910	3.5821	5.3731	7.1642	8.9552	10.7462	12.5373	14.3283	16.1193
3.40	1.7647	3.5294	5.2941	7.0588	8.8235	10.5882	12.3529	14.1176	15.8823
3.45	1.7391	3.4783	5.2174	6.9565	8.6957	10.4348	12.1739	13.9130	15.6522
3.50	1.7143	3.4286	5.1428	6.8571	8.5714	10.2857	12.0000	13.7142	15.4285
3.55	1.6901	3.3803	5.0704	6.7606	8.4507	10.1408	11.8310	13.5211	15.2113
3.60	1.6667	3.3333	5.0000	6.6667	8.3333	10.0000	11.6667	13.3333	15.0000
3.65	1.6438	3.2877	4.9315	6.5753	8.2191	9.8630	11.5068	13.1506	14.7945
3.70	1.6216	3.2432	4.8649	6.4865	8.1081	9.7297	11.3513	12.9730	14.5946
3.75	1.6000	3.2000	4.8000	6.4000	8.0000	9.6000	11.2000	12.8000	14.4000
3.80	1.5789	3.1579	4.7368	6.3158	7.8947	9.4736	11.0526	12.6315	14.2105
3.85	1.5584	3.1169	4.6753	6.2338	7.7922	9.3506	10.9091	12.4675	14.0260
3.90	1.5385	3.0769	4.6154	6.1538	7.6923	9.2308	10.7692	12.3077	13.8461
3.95	1.5190	3.0380	4.5569	6.0759	7.5949	9.1139	10.6329	12.1518	13.6708
4.00	1.5000	3.0000	4.5000	6.0000	7.5000	9.0000	10.5000	12.0000	13.5000
4.05	1.4815	2.9630	4.4444	5.9259	7.4074	8.8889	10.3704	11.8518	13.3333
4.10	1.4634	2.9268	4.3902	5.8536	7.3170	8.7804	10.2438	11.7072	13.1706
4.15	1.4458	2.8916	4.3373	5.7831	7.2289	8.6747	10.1205	11.5662	13.0120
4.20	1.4286	2.8571	4.2857	5.7141	7.1428	8.5714	10.0000	11.4285	12.8570
4.25	1.4118	2.8235	4.2353	5.6469	7.0588	8.4706	9.8823	11.2941	12.7058

M. E. P. WITH 40 INDICATOR SPRING.

LENGTH. In.	.1	.2	.3	.4	.5	.6	.7	.8	.9
2.75	1.4545	2.9091	4.3636	5.8182	7.2727	8.7273	10.1818	11.6364	13.0909
2.80	1.4286	2.8571	4.2857	5.7143	7.1429	8.5714	10.0000	11.4286	12.8571
2.85	1.4035	2.8070	4.2105	5.6140	7.0175	8.4210	9.8246	11.2281	12.6316
2.90	1.3793	2.7586	4.1379	5.5172	6.8966	8.2759	9.6552	11.0345	12.4138
2.95	1.3559	2.7119	4.0678	5.4237	6.7797	8.1356	9.4915	10.8474	12.2034
3.00	1.3333	2.6667	4.0000	5.3333	6.6667	8.0000	9.3333	10.6667	12.0000
3.05	1.3115	2.6229	3.9344	5.2459	6.5574	7.8688	9.1803	10.4918	11.8033
3.10	1.2903	2.5806	3.8710	5.1613	6.4516	7.7419	9.0323	10.3226	11.6129
3.15	1.2698	2.5397	3.8095	5.0794	6.3492	7.6191	8.8889	10.1587	11.4286
3.20	1.2500	2.5000	3.7500	5.0000	6.2500	7.5000	8.7500	10.0000	11.2500
3.25	1.2308	2.4615	3.6923	4.9231	6.1538	7.3846	8.6154	9.8462	11.0769
3.30	1.2121	2.4242	3.6364	4.8485	6.0606	7.2727	8.4848	9.6970	10.9091
3.35	1.1940	2.3981	3.5821	4.7961	5.9701	7.1642	8.3582	9.5922	10.7463
3.40	1.1765	2.3529	3.5294	4.7059	5.8824	7.0588	8.2353	9.4118	10.5882
3.45	1.1594	2.3188	3.4783	4.6377	5.7971	6.9565	8.1159	9.2754	10.4348
3.50	1.1429	2.2857	3.4286	4.5714	5.7143	6.8571	8.0000	9.1428	10.2857
3.55	1.1268	2.2535	3.3803	4.5070	5.6338	6.7606	7.8873	9.0141	10.1408
3.60	1.1111	2.2222	3.3333	4.4444	5.5555	6.6667	7.7778	8.8889	10.0000
3.65	1.0959	2.1918	3.2877	4.3836	5.4794	6.5753	7.6712	8.7671	9.8630
3.70	1.0811	2.1622	3.2432	4.3243	5.4054	6.4865	7.5676	8.6486	9.7297
3.75	1.0667	2.1333	3.2000	4.2667	5.3333	6.4000	7.4667	8.5333	9.6000
3.80	1.0526	2.1053	3.1579	4.2105	5.2631	6.3158	7.3684	8.4210	9.4737
3.85	1.0390	2.0779	3.1169	4.1558	5.1948	6.2338	7.2727	8.3117	9.3506
3.90	1.0256	2.0513	3.0769	4.1026	5.1282	6.1538	7.1795	8.2051	9.2308
3.95	1.0127	2.0253	3.0380	4.0506	5.0633	6.0759	7.0886	8.1013	9.1139
4.00	1.0000	2.0000	3.0000	4.0000	5.0000	6.0000	7.0000	8.0000	9.0000
4.05	.9877	1.9753	2.9629	3.9506	4.9382	5.9259	6.9135	7.9012	8.8888
4.10	.9756	1.9512	2.9268	3.9024	4.8780	5.8537	6.8294	7.8048	8.7604
4.15	.9639	1.9277	2.8915	3.8554	4.8192	5.7831	6.7469	7.7108	8.6746
4.20	.9524	1.9047	2.8571	3.8094	4.7617	5.7143	6.6664	7.6188	8.5711
4.25	.9412	1.8823	2.8235	3.7646	4.7057	5.6471	6.5883	7.5292	8.4703

PLATE 1.

PRINCIPAL DIMENSIONS OF ARMINGTON & SIMS DOUBLE-DISC ENGINES.

REFERENCE LETTERS ON DIAGRAM. (All Dimensions in Inches.)

Class Letter.	Cylinder. Diam. Ins.	Cylinder. Stroke. Ins.	A	B	C	D	E	F	G	H	I	J	K	L	M
A	6 1/2	8	27	13 5/8	10 7/8	13 3/8	10 5/8	10 7/8	23 5/8	12 1/4	14 1/2	34 1/4	34 1/4	5 1/2	6
B	8 1/2	10	30 3/8	14 5/8	14 1/8	17	21 3/4	20 3/4	28 1/2	14 3/8	16 3/8	40	40	7	8 1/2
C	9 1/2	12	45 3/4	15 3/8	15 3/8	18 1/2	25 3/16	22 3/8	31 1/4	16	17 1/4	47	47	8 1/2	10 1/2
E	13	13	See Y & Z	17 3/8	14	24 1/4	32 1/4	32 5/8	30 1/2	20 15/16	19 3/4	23 3/4	60	6 1/2	13
F	14 1/2	13		17 3/8	17 3/8	25 3/8	34 1/2	34	38	20	20	23 3/4	60	6 1/2	13

Class Letter.	N	O	P	Q	R	S	S′	T	U	V	W	X	Y	Z	Steam Pipe. Ins.	Exhaust Pipe. Ins.
A	57 5/8	7 1/4	13 1/4	57 3/4	11	10 1/2	6 1/2	4	8 3/16	3	9 1/4	50 3/8	0	0	2	2 1/2
B	71 5/8	9 3/4	17 3/4	72 3/4	13	12 5/8	7 3/8	4 7/16	11	3 1/2	10 3/4	62 5/16	0	0	2 1/2	3
C	83 5/16	10 3/8	18 7/8	83 1/2	15 3/4	13 3/4	8 1/4	4 13/16	12 3/8	3 1/2	12	72 13/16	0	0	3	3 1/2
E	100 5/16	11 1/2	20 3/4	97 1/2	20 1/4	18 7/16	11 1/8	6 7/16	15 3/8	4	14 1/2	87	27	27 1/4	4 1/2	6
F	105 5/8	11 1/2	24	100	23 1/4	19 5/16	13	6 3/4	15 3/4	4	14 1/2	89 1/2	27 1/4	27 1/4	5	6

NOTE—The E and F class of engines are made with the steam-chest on opposite side of cylinder from that shown on plan.

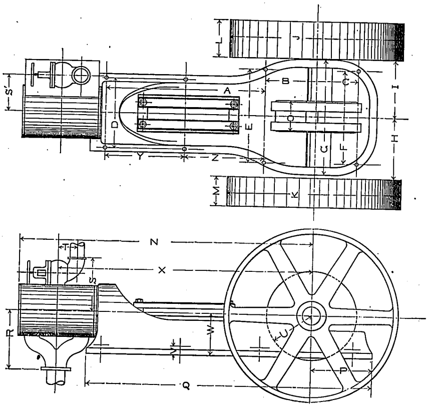


PLATE 1.

EXHAUST PIPE.
Ins.
2½
3
3½
6
6

PLATE 2.

DIMENSIONS OF FOUNDATIONS FOR DOUBLE-DISC ENGINES.

Class Letter.	Cylinder. Diam. Ins.	Cylinder. Stroke. Ins.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	V′	W	X	Y	Z	Bolts. No.	Bolts. Diam.	Pipes. Length.	Pipes. Diam.	No. of Bricks.
			Reference Letters on Diagram. (All Dimensions in Inches).																															
A	6½	8	27	13⅜	10⅞	13⅜	16⅝	16⅞	46½	20½	67	56	30	86	96	24	44	54	5	52¼	3⅞	10	31	17	4	9	58	0	0	6	⅝	42	1	2,600
B	8½	10	36⅜	14⅝	14⅛	17	21¾	20¾	56½	22½	79	67	33	100	120	28⅝	48	68	10	65¼	4⅝	12	42	18	4	10¾	72	0	0	6	¾	54	1¼	4,600
C	9½	12	45¾	15⅜	15⅜	18½	$25\frac{5}{16}$	22⅜	66	24	90	84	42	126	138	31¼	56	68	6	71¼	4⅝	12	46	20	6	12	78	0	0	6	⅞	60	1½	5,650
E	13	13	See Y & Z.	17⅜	14	24¼	32¼	32⅞	78	30	108	97	49	146	158	40	78	90	6	78½	5⅜	12	50	22	6	14½	84	27	27¼	8	1⅛	66	2	9,100
F	14½	13		17⅜	17⅜	25⅜	34½	34	78	30	108	97½	49½	147	159	39	78	90	6	84¾	5¾	12	56½	21½	6	14½	90	27¼	27¼	8	1⅛	72	2	10,100

Note. A cast-iron bed plate, to be used in place of cap-stone, will be furnished for the above foundations if preferred, at the following prices:

6½″ × 8″ engine $20 40
8½″ × 10″ " 28 40
9½″ × 12″ " 35 00
13″ × 13″ " 63 20
14½″ × 13″ " 63 20

No. of Bricks.
2,600
4,600
5,050
9,100
10,100

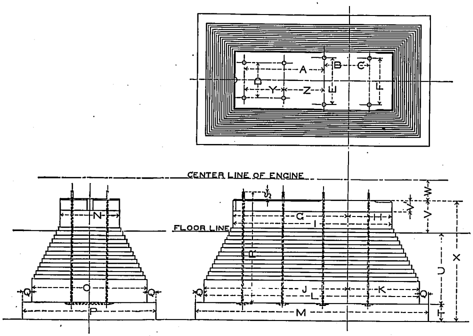


PLATE 2.

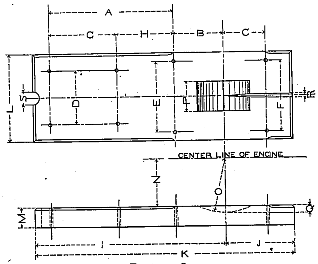


PLATE 3.

DIMENSIONS OF FOUNDATION CAP-STONES FOR DOUBLE-DISC ENGINES.

Class Letter.	Cylinder.		Reference Letters on Diagram. (All Dimensions in Inches.)																			Drill Holes. Ins.
	Diam. Ins.	Stroke. Ins.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
A	6½	8	27	13⅜	10⅞	13⅜	16⅝	16⅞	0	0	46½	20½	67	24	4	9	0	0	1	1	4	1
B	8½	10	36⅝	14⅝	14⅛	17	21¾	20¾	0	0	56½	22½	79	28⅝	4	10¾	11¼	10	1¼	1	4	1¼
C	9½	12	45¾	15⅜	15⅜	18½	25$\frac{3}{16}$	22⅜	0	0	66	24	90	31¼	6	12	13½	12	2	1½	4	1¼
E	13	18	See G & H.	17⅜	14	24¼	32¼	32⅞	27	27¼	78	30	108	40	6	14½	16	12	2	1½	4	1½
F	14½	18		17⅜	17⅜	25⅜	34½	34	27¼	27¼	78	30	108	30	6	14½	16½	12	2½	2	4	1½

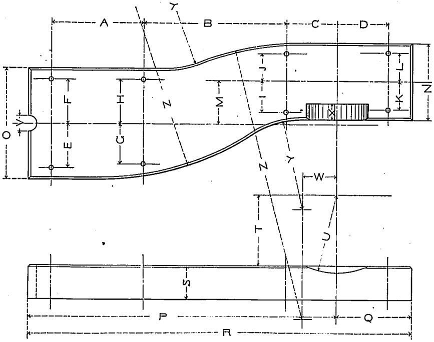


PLATE 4.

DIMENSIONS OF CAP-STONES FOR 12½″ × 20″ AND 14½″ × 24″ ENGINES.

Reference Letter.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Drill Holes.
12½″×20″	3′ 2″	2′ 11″	1′ 0⅞″	1′ 0⅝″	11⅝″	11⅝″	10⅜″	11⅝″	8¼″	0⅝″	7⅛″	7½″	1′ 1⅛″	1′ 11″	2′ 8″	8′ 4″	2′ 3″	10′ 7″	1′ 0″	1′ 2½″	1′ 0½″	5″	10″	5¾″	2′ 5″	6′ 4″	2½ ins.
14½″×24″	3′ 9″	3′ 5″	1′ 11½″	1′ 8¼″	1′ 1⅛″	1′ 1⅛″	1′ 0¼″	1′ 1⅛″	10½″	7″	8½″	8½″	1′ 2½″	2′ 2″	3′ 0″	9′ 10″	2′ 6″	12′ 4″	10″	1′ 2¼″	1′ 8½″	6″	9½″	8½″	5′ 0″	5′ 10″	2½ ins.

PLATE 5.

PRINCIPAL DIMENSIONS OF THE 12½″ × 20″ AND 14½″ × 24″ ENGINES.

Reference Letter	A	B	C	D	E	F	G	H	I	J	K	L	M	N
12½″×20″	3′ 2″	2′ 11″	1′ 6⅞″	1′ 6⅝″	11⅝″	11⅝″	10⅜″	11⅝″	8¼″	6⅝″	7⅛″	7½″	1′ 1⅛″	3′ 9½″
14½″×24″	3′ 9″	3′ 5″	1′ 11½″	1′ 8½″	1′ 1⅛″	1′ 1⅛″	1′ 0½″	1′ 1⅛″	10½″	7″	8½″	8½″	1′ 2½″	4′ 11½″

Reference Letter	O	P	Q	R	S	T	U	V	W	X	X′	Y	Z
12½″×20″	1′ 6″	1′ 2″	10′ 7½″	9′ 2¾″	8′ 0⅝″	1′ 11⅝″	6′ 0″	2′ 3¼″	1′ 5 9/16″	6 7/16″	11⅛″	4″	1′ 2½″
14½″×24″	1′ 6½″	1′ 8″	12′ 6⅝″	10′ 10¾″	9′ 7″	2′ 2″	6′ 0″	2′ 4⅝″	1′ 7 5/16″	6¾″	1′ 0¾″	4½″	1′ 4¼″

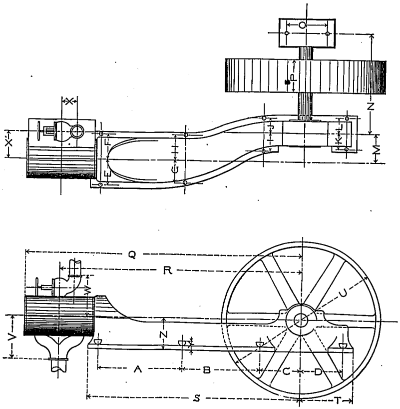


PLATE 5.

PLATE 6.

PRINCIPAL DIMENSIONS OF THE 16½″ × 24″ AND 18½″ × 30″ ENGINES.

Reference Letter	A	B	B′	B″	C	C′	D	E	F	G	G′	H	H′	I	J	K
16½″×24″	2′ 7¾″	2′ 9¼″	2′ 4¾″	2′ 0½″	1′ 3⅞″	1′ 10⅞″	1′ 9⅜″	1′ 3⅞″	1′ 3⅞″	1′ 3¼″	5¾″	1′ 3⅞″	1′ 10⅞″	10⅜″	10½″	10⅜″
18½″×30″	3′ 1½″	3′ 0″	3′ 0″	3′ 0″	1′ 11½″	1′ 11½″	2′ 3½″	1′ 6″	1′ 6″	1′ 5 7/16″	6¼″	1′ 6″	2′ 0″	1′ 0″	1′ 0″	1′ 0″

Reference Letter	L	M	N	O	P	Q	R	S	T	U	V	W	X	X′	Y	Z
16½″×24″	10⅜″	1′ 4¼″	5′ 5½″	1′ 8″	2′ 0″	12′ 8½″	11′ 0 5/16″	9′ 8⅝″	2′ 4⅛″	7′ 0″	2′ 5⅝″	1′ 10¼″	7½″	1′ 2″	5½″	1′ 6″
18½″×30″	1′ 0″	1′ 5¼″	6′ 0″	2′ 2″	2′ 4″	15′ 4¾″	13′ 5¾″	11′ 11½″	3′ 1″	9′ 0″	3′ 4⅛″	1′ 11⅛″	8 3/16″	1′ 3¾″	7″	1′ 9″

K	Z
10⅝″	1′ 6″
1′ 0″	1′ 9″

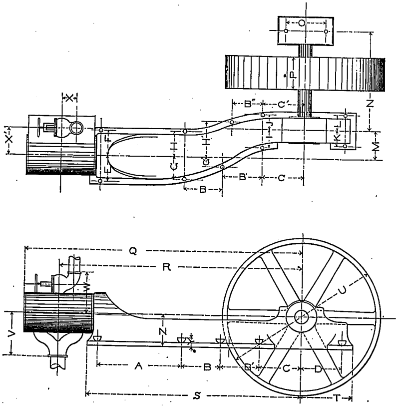


PLATE 6.

PLATE 7.

DIMENSIONS OF FOUNDATIONS FOR SINGLE-DISC ENGINES.

Reference Letter.	12½″ × 20″.		14½″ × 24″.		16½″ × 24″.		18½″ × 30″.		Reference Letter.
	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	
A	8	4	9	10	10	0	13	4	A
B	2	8	2	6	2	8	3	6	B
C	10	0	11	6	11	8	14	0	C
D	4	0	4	2	4	4	5	2	D
E	4	1	4	8	5	3	5	10	E
F	5	5	6	0	6	7	7	2	F
G	1	6	1	10	2	2	2	6	G
H	2	4	2	6	2	10	3	2	H
I	3	0½	4	11½	5	5¼	6	0	I
J	1	10	1	10	1	10	2	0	J
K	1	8	1	8	1	8	1	10	K
L	1	6	1	6½	1	8	2	4	L
M	2	10	3	0	3	0	3	6	M
N	8	0	8	4	8	8	10	4	N
O	1	2¼	1	4¼	1	6	1	9	O
No. of Bricks..	12,855		15,844		18,288		25,970		
Diam. of Bolts.	1⅛ Ins.		1¼ Ins.		1⅜ Ins.		1½ Ins.		

Reference Letter.	12½″ × 20″.		14½″ × 24.″		16½″ × 24″.		18½″ × 30.″		Reference Letter.
	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	
O′	1	1⅛	1	2¼	1	4¼	1	5¼	O′
P	1	0	1	0	1	0	1	0	P
Q	4	6	5	0	5	6	6	0	Q
R	1	0	1	0	1	0	1	0	R
S	0	0½	0	7	0	7¾	0	8¾	S
T	0	6	0	6	0	6	0	6	T
U	1	8	1	8	1	8	2	0	U
V	1	4	1	8	1	8	2	0	V
W	6	1¼	6	8	7	3	7	10½	W
W′	6	0¾	7	2¾	7	9¾	8	6¾	W′
X	0	6	0	6½	0	7½	0	9	X
Y	3	6	3	9	4	0	5	0	Y
Z	15	0	16	8	17	0	20	2	Z
Z′	10	5⅝	12	0	13	11¼	14	0¼	Z′
No. of Bricks..	12,855		15,844		18,288		25,970		
Diam. of Bolts.	1⅛ Ins.		1¼ Ins.		1⅜ Ins.		1½ Ins.		

Reference Letter.
O′
P
Q
R
S
T
U
V
W
W′
X
Y
Z
Z′

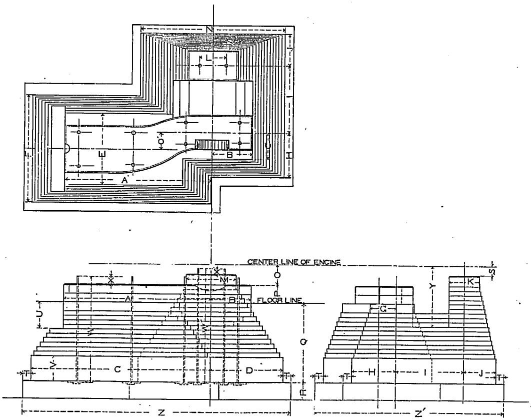


PLATE 7.

PLATE 8.

DIMENSIONS OF CAP-STONES FOR 16½″ × 24″ AND 18½″ × 30″ ENGINES.

Reference Letter	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Drill Holes.
16½″×24″	2′ 7¾″	2′ 6″	2′ 0¼″	1′ 10⅞″	1′ 9⅝″	1′ 8⅞″	2′ 4¾″	2′ 0¼″	1′ 3⅞″	1′ 3⅞″	1′ 3¼″	1′ 3⅞″	5¾″	1′ 10⅞″	10⅝″	10½″	3 ins.
18½″×30″	3′ 1½″	3′ 0″	3′ 0″	1′ 11½″	2′ 3″	1′ 11½″	3′ 0⅝″	3′ 0⅛″	1′ 6″	1′ 6″	1′ 5 7/16″	1′ 6″	6¼″	2′ 0″	1′ 0″	1′ 0″	3 ins.

Reference Letter	Q	R	S	T	U	V	W	X	Y	Z	A′	B′	C′	D′	E′	F′	Drill Holes.
16½″×24″	10⅜″	10⅜″	2′ 3″	10′ 0″	12′ 8″	2′ 6″	3′ 6″	1′ 0″	6″	8″	1′ 6″	1′ 10″	7′ 6″	4′ 0″	1′ 3¼″	1′ 4¼″	3 ins.
18½″×30″	1′ 0″	1′ 0″	3′ 6″	12′ 4″	15′ 10″	2′ 10″	4′ 0″	1′ 0″	6″	10″	1′ 9″	2′ 0″	8′ 6″	3′ 6″	2′ 4¼″	1′ 5¼″	3 ins.

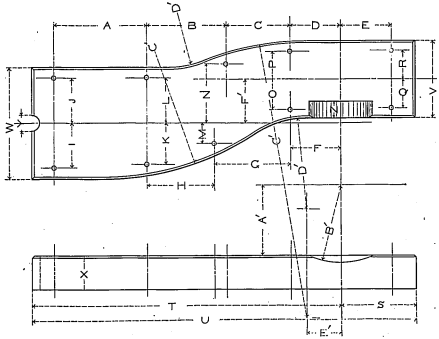


PLATE 8.

FIXTURES.

CATALOGUE AND PRICE-LIST

—OF—

EDISON LIGHT FIXTURES,

MANUFACTURED BY

MESSRS. BERGMANN & CO.

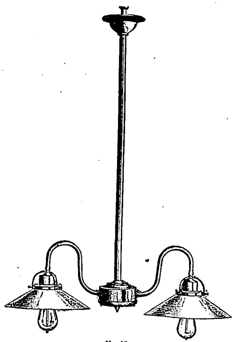
292 to 298 AVENUE B, NEW YORK CITY.

These Electroliers, Brackets, etc., are especially designed for the Edison Incandescent Electric Lamp. They are provided with the standard sockets and wired in the best manner, in accordance with the requirements of the Board of Fire Underwriters and the rules laid down by the Engineering Department of the Edison Company. There is a large variety of designs of various prices, from which selections can be made suitable for all classes of work.

Most of the devices and fixtures illustrated in the following catalogue are manufactured and sold under patents which are controlled exclusively by the Edison Company and Messrs. Bergmann & Co., and the public are respectfully cautioned against all infringements of the same.

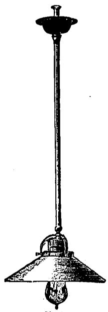
The illustrations in the catalogue represent only such leading styles of fixtures as its space permits us to show. It will be observed that the use of the Edison Incandescent Light offers a wider field for ornamentation in Electroliers, Brackets, etc., than that of gas. Special designs and estimates for all styles and classes of work will be furnished.

The length of Electroliers is measured from the top coupling down to the lowest point of the lamps, excepting where the body of the fixture extends below the lamps, in which case it is measured to the lowest point of the body. The spread of all fixtures is measured from tip to tip of opposite lamps.

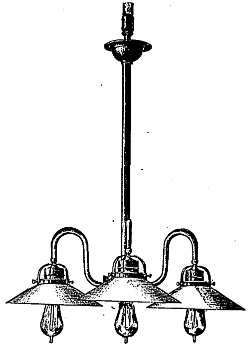


No. 10.

Length, 3 ft. 6 in. Spread, 17 in.



No. 5.



No. 20.

Length, 3 ft. 6 in. Spread, 17 in.

PLAIN ELECTROLIERS.

		Bronzed.	Pol'd Brass.	Gold Bronze.
No. 5, 1 Light, including Key Sockets,	Price	$1 70	$3 40	$3 65
No. 10, 2 " " "	"	7 00	9 50	10 00
No. 20, 3 " " "	"	9 30	12 00	12 75

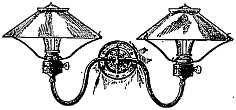
Shades and Holders not included in above price. Canopy not included in price of No. 5 Bronzed.

s below the

Gold Bronze.
$3 65
10 00
12 75

Prices are for lengths given. When longer fixtures are required, the following are the prices of extra lengthening.

Bronzed,	per foot,	Price	$0 15
Polished Brass,	"	"	60
Gold Bronze,	"	"	70

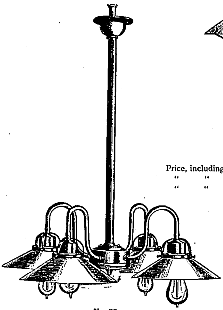


No. 350.

PLAIN BRACKET.

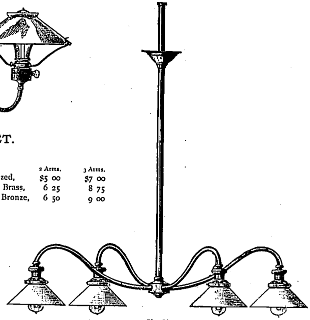
Spread, 12½ in.

		2 Arms.	3 Arms.
Price, including Key Sockets,	Bronzed,	$5 00	$7 00
" " "	Pol'd Brass,	6 25	8 75
" " "	Gold Bronze,	6 50	9 00



No. 30.

Length, 3 ft. 6 in. Spread, 17 in.



No. 11.

Length, 3 ft. 6 in. Spread, 30 in.

PLAIN ELECTROLIERS.

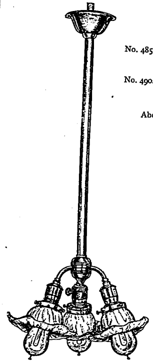
		Bronzed.	Pol'd Brass.	Gold Bronze.
No. 30, 2 Light, including Key Sockets,	Price	$7 00	$9 50	$10 00
3 " " "	"	9 30	12 00	12.75
4 " " "	"	11 40	14 50	15 50
6 " " "	"	15 50	19 00	20 50

		Bronzed.	Pol'd Brass.	Gold Bronze.
No. 11, 2 Light, including Key Sockets,	Price	$7 00	$9 60	$10 20
3 " " "	"	9 30	12 20	13 00
4 " " "	"	11 40	14 60	15 75
6 " " "	"	15 50	19 20	21 00

Above prices do not include Shades or Holders.

No. 485.	Price, including Key Sockets,	. . .	Bronzed,	$5 00
	" " "	. . . .	Polished Brass,	6 25
	" " "	. . .	Gold Bronze,	6 75
No. 490.	" " "	. . . .	Bronzed,	6 00
	" " "	. . . .	Polished Brass,	7 25
	" " "	. . . .	Gold Bronze,	7 75

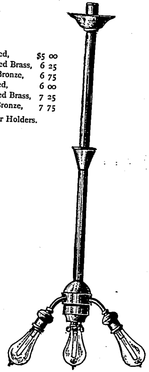
Above prices do not include Glass Flowers, Shades, Globes, or Holders.



No. 485.

THREE-LIGHT PENDANT.

Length, 3 ft. Spread, 12 to 18 in.

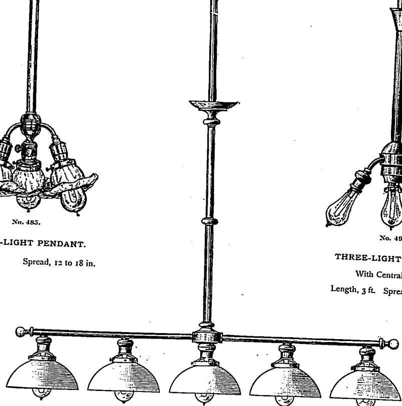


No. 490.

THREE-LIGHT PENDANT,

With Central Switch.

Length, 3 ft. Spread, 12 to 18 in.



No. 495.

SHOW WINDOW PENDANT.

Length, 3 ft. 6 in.

		Three Lights. Spread, 30 in.	Five Lights. Spread, 50 in.	Seven Lights. Spread, 70 in.	Nine Lights. Spread, 90 in.
Bronzed, including Key Sockets,	Price	$8 50	$11 00	$13 50	$16 00
Polished Brass, " "	"	11 00	13 75	16 50	19 25
Gold Bronze, " "	"	11 50	14 35	17 30	20 35

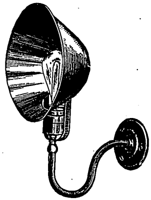
Glass Flowers, Globes, or Holders not included in above prices.

SHOW WINDOW PENDANT.

Length, 3 ft. 6 in.

		Three Lights. Spread, 30 in.	Five Lights. Spread, 50 in.	Seven Lights. Spread, 70 in.	Nine Lights. Spread, 90 in.
Bronzed, including Key Sockets,	Price	$8 50	$11 00	$13 50	$16 00
Polished Brass, " "	"	11 00	13 75	16 50	19 25
Gold Bronze, " "	"	11 50	14 35	17 30	20 35

Glass Flowers, Globes, or Holders not included in above prices.



No. 65.

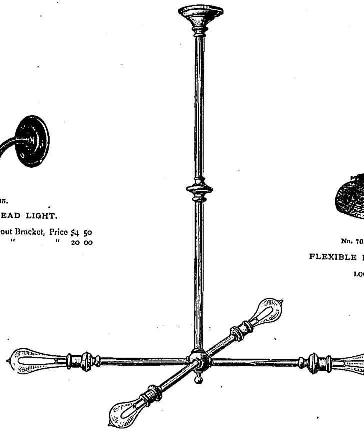
PARABOLIC HEAD LIGHT.

10 inch, Nickel Plated, without Bracket, Price $4 50
15 inch, Silvered Glass, " " 20 00

No. 765. Patented.

FLEXIBLE BAND PENDANT.

LOOPED UP.



No. 760.

BILLIARD PENDANT.

			Two Lights.	Four Lights.
No. 760	Spread, 54 in. x 22 in.	Bronzed,	$6 75	$11 00
	Length, 3 ft. 6 in.	Pol'd Brass,	9 00	13 75
	Price, including Key Sockets,	Gold Bronze,	9 50	15 00

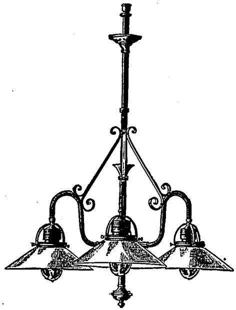
No. 765. Patented.

FLEXIBLE BAND PENDANT.

This Pendant is admirably suited for Mill Work and other places where cheapness is desired. The Electrical Conductors are woven into a flexible band, which permits of raising and lowering the light to any desired position, as shown in cuts.

Price, Plain, 3 ft. long, including Key Socket and Top Plug, . $2 00
Price of extra lengthening, per foot, ... 12

The plain fixture can be ornamented by fringing, embroidery, etc., to suit any taste. It is portable, and can be used as a drop light from any Electrolier or Bracket.

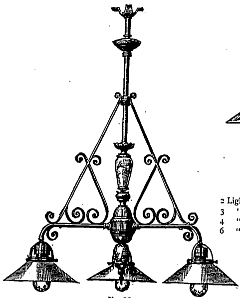


No. 24.

Length, 36 in. Spread 19 in.

		Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price,	$12 50	$14 00
3 " " "	"	16 50	18 50
4 " " "	"	20 50	23 00
6 " " "	"	28 50	31 50

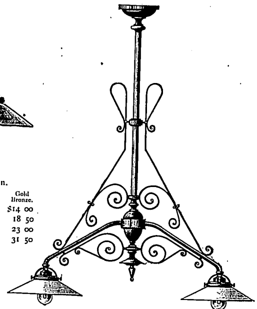
ORNAMENTAL ELECTROLIERS.



No. 26.

Length, 39 in. Spread 24 in.

		Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price,	14 50	$16 00
3 " " "	"	19 50	21 50
4 " " "	"	24 50	27 00
6 " " "	"	34 50	38 00



No. 23.

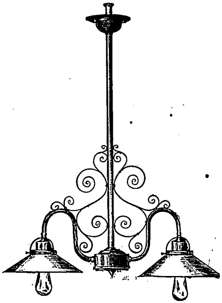
Length, 42 in. Spread, 24 in.

		Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price,	$16 00	$18 00
3 " " "	"	22 00	25 00
4 " " "	"	27 50	31 00
6 " " "	"	39 50	44 00

Above Prices do not include Shades or Holders.

No. 69.

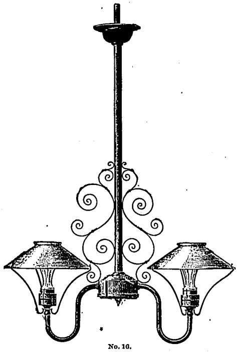
PLAIN BRACKET.



No. 15.

No. 130.

HAND LAMP.



No. 16.

ORNAMENTAL ELECTROLIER.

Length, 42 in. Spread, 17 in.

ORNAMENTAL ELECTROLIER.

Length, 42 in. Spread, 17 in.

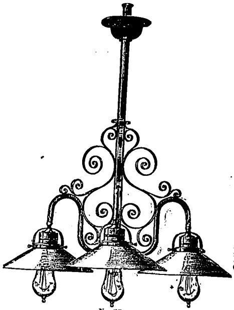
No. 15, including Key Sockets,		Polished Brass,	$10 80
No. 16, " "		Gold Bronze,	11 50
No. 130, " "	Hand Lamp,	Polished Brass,	4 00
No. 130, " "	"	Gold Bronze,	4 25

No. 69, Plain Bracket, Length 8 in., including Key Socket,

Bronzed,	$1 80
Polished Brass,	2 25
Gold Bronze,	2 40

Shades and Holders not included in above prices.

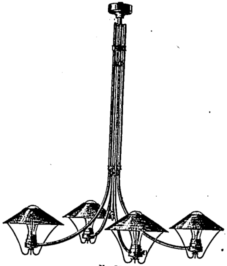
ELECTROLIERS.



No. 25.

ORNAMENTAL ELECTROLIER.

Length, 42 in. Spread, 17 in.

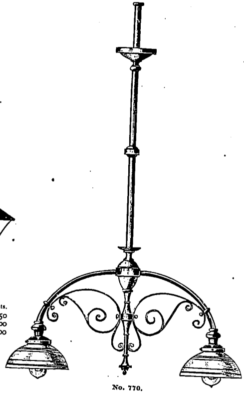


No. 32.

PLAIN ELECTROLIER.

Length, 42 in. Spread, 30 in.

	Two Lights.	Four Lights.
Bronzed, including Key Sockets,	$4 25	$9 50
Polished Brass, " "	7 25	13 00
Gold Bronze, " "	9 00	14 00



No. 770.

ORNAMENTAL ELECTROLIER.

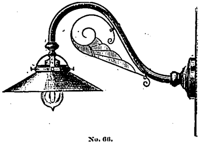
Length, 42 in. Spread, 24 in.

		Pol'd Brass.	Gold Bronze.
3 Lights, including Key Sockets,	Price,	$14 75	$15 75
4 " " "	"	18 00	19 50
6 " " "	"	24 50	27 00

		Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price,	$12 50	$14 00
3 " " "	"	16 50	18 50
4 " " "	"	20 50	23 00
6 " " "	"	28 50	31 50

Globes, Shades or Holders not included in above prices.

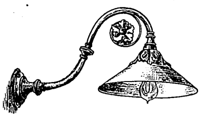
	Gold Bronze.
	$14 00
	18 50
	23 00
	31 50



No. 66.

ORNAMENTAL BRACKET.

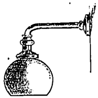
Length, 12 in.



No. 435.

ORNAMENTAL BRACKET.

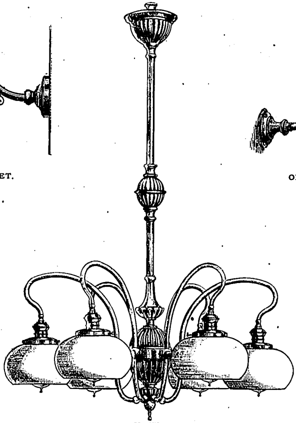
Length, 12 in.



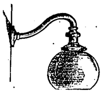
No. 440.

PLAIN BRACKET.

Length, 8 in.



No. 450.



No. 445.

PLAIN BRACKET.

Length, 8 in.

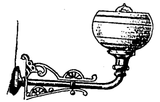
ORNAMENTAL ELECTROLIER.

Length, 42 in. Spread, 23½ in.

		Bronzed.	Pol'd Brass.	Gold Br'ze.
No. 440, Bracket, including Key Sockets,	Price	$1 75	$2 20	$2 35
No. 66, " " "	"		3 65	3 80
No. 445, " " "	"	1 80	2 25	2 40
No. 435, " " "	"		5 25	5 50

		Pol'd Brass.	Gold Bronze.
No. 450, 2 Lights, including Key Sockets,	Price	$16 00	$17 50
3 " " "	"	20 50	22 75
4 " " "	"	25 00	28 00
5 " " "	"	29 50	33 25
6 " " "	"	34 00	38 50

Globes, Shades, or Holders not included in above prices.

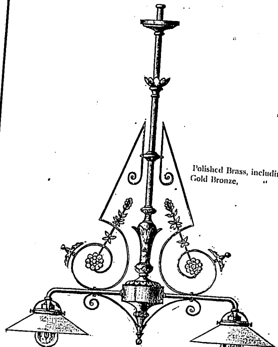


No. 235.

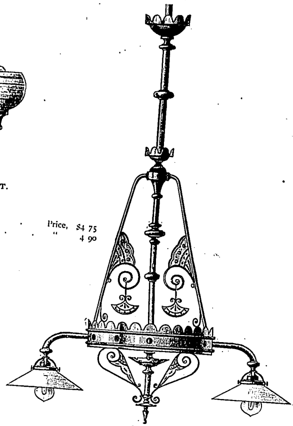
ORNAMENTAL BRACKET.

Length, 10 in.

Polished Brass, including Key Sockets,	Price,	$4 75
Gold Bronze, " "	"	4 90



No. 27.
Length, 46 in. Spread, 24 in.



No. 28.
Length, 48 in. Spread, 24 in.

ORNAMENTAL ELECTROLIERS.

No. 27:

		Polished Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price,	$18 00	$19 50
3 " " "	"	24 75	27 00
4 " " "	"	31 50	34 50
6 " " "	"	44 00	48 50

No. 28:

		Polished Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price,	$20 50	$22 50
3 " " "	"	28 00	31 00
4 " " "	"	35 50	39 50
6 " " "	"	49 50	54 50

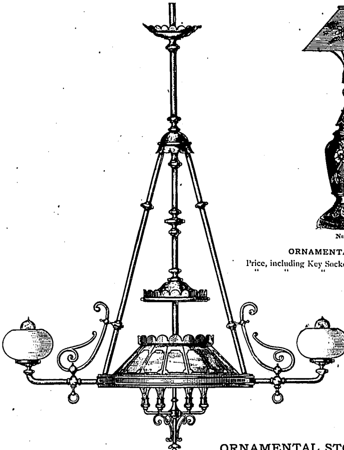
Globes or Shades not included in above prices.

With 2 Arm
4 "
6 "

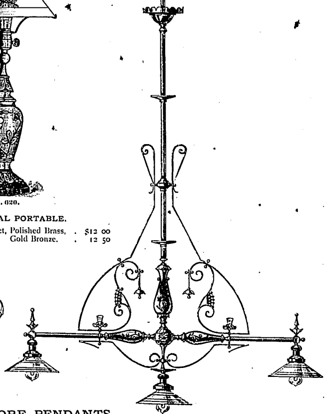
No. 620.

ORNAMENTAL PORTABLE.

Price, including Key Socket, Polished Brass,	.	$12 00
" " " Gold Bronze,	.	12 50



No. 625.



No. 670.

ORNAMENTAL STORE PENDANTS.

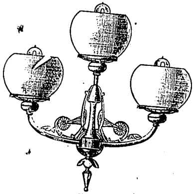
No. 625. Length, 60 in. Spread, 36 in.

		Pol'd Brass.	Gold Bronze.
With 2 Arms, including Key Sockets,	Price	$50 00	$54 00
4 " " "	"	63 00	70 00
6 " " "	"	75 00	85 00

Prices include 18 in. Centre Reflector, with four Key Sockets.
Shades or Holders are not included in above prices.

No. 670. Length, 60 in. Spread, 48 in.

		Pol'd Brass.	Gold Bronze.
2 Lights, without Centre Light, including Key Sockets,	Price	$20 00	$22 50
4 " " " " "	"	30 00	35 00
6 " " " " "	"	40 00	47 50
2 " and " " "	"	21 50	24 00
4 " " " " "	"	31 50	36 50
6 " " " " "	"	41 50	49 00

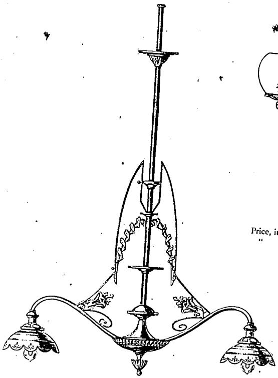


No. 80.

ORNAMENTAL BRACKET.

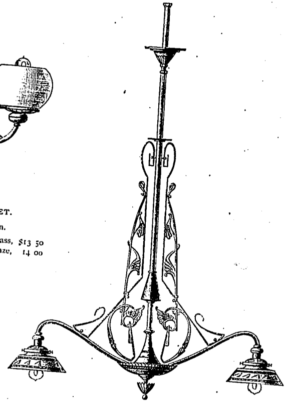
Three Lights. Spread, 13 in.

Price, including Key Sockets, Pol'd Brass, $13 50
" " " Gold Bronze, 14 00



No. 300.

Length, 42 in. Spread, 26 in.



No. 505.

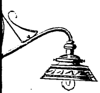
Length, 40 in. Spread, 26 in.

ORNAMENTAL ELECTROLIERS.

		Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price	$19 50	$21 50
3 " " "	"	25 50	28 50
4 " " "	"	31 50	35 50
6 " " "	"	43 50	49 50

		Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price	$23 50	$26 00
3 " " "	"	31 50	35 25
4 " " "	"	39 50	44 00
6 " " "	"	55 50	62 00

Globes, Shades or Holders are not included in above prices.



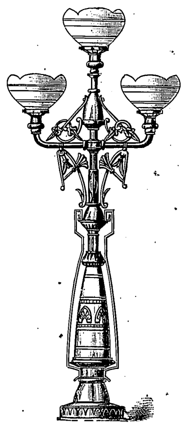
6 in.

	Pol'd Brass.	Gold Bronze.
Price	$23 50	$26 00
"	31 50	35 25
"	39 50	44 00
"	55 50	62 00

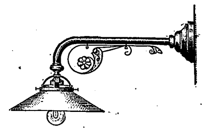
No. 63.

ORNAMENTAL BRACKET.

Length, 12 in.



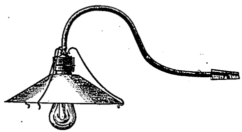
No. 605.



No. 64.

ORNAMENTAL BRACKET.

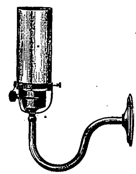
Length, 12 in.



No. 62.

PLAIN BRACKET.

Length, 12 in.



No. 68.

PLAIN BRACKET.

Length, 8 in.

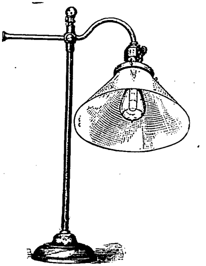
ORNAMENTAL NEWELL.

Height, 69 in. Spread, 20 in.

		Bronzed.	Pol'd Brass.	Gold Bronze.
No. 62, Bracket, including Key Socket,	Price	$1 90	$2 35	$2 50
No. 63, " " "	"		3 00	3 20
No. 64, " " "	"		3 75	3 90
No. 68, " " "	"	1 80	2 25	2 40
Ground Glass Argand Chimney, shown in No. 68,				40

		Pol'd Brass.	Gold Bronze.
No. 605, 2 Lights and Centre Light, including Key Sockets,	Price	$60 00	$65 00
No. 605, 3 " " " "	"	68 50	74 00
No. 605, 4 " " " "	"	77 00	83 00

Globes, Shades or Holders are not included in above prices.

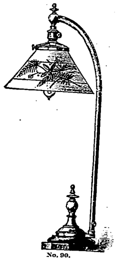


No. 85. Patented.

SLIDING STUDENT LAMP.

- Having both Lateral and Vertical Adjustment.

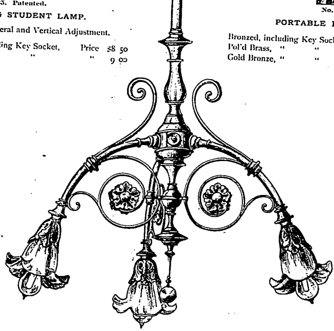
Polished Brass, including Key Socket,	Price	$8 50
Gold Bronze, " "	"	9 00



No. 90.

PORTABLE DESK LAMP.

Bronzed, including Key Socket,	Price	$4 50
Pol'd Brass, " "	"	5 50
Gold Bronze, " "	"	5 75



No. 95.

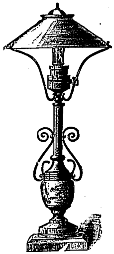
ORNAMENTAL ELECTROLIER.

Length, 50 in. Spread, 25 in.

		Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price	$26 00	$29 00
3 " " "	"	36 00	40 00
4 " " "	"	45 00	50 00
5 " " "	"	53 00	59 00
6 " " "	"	60 00	67 00

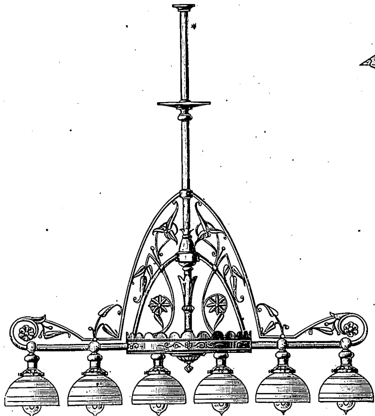
Glass Flowers, Shades or Holders not included in above prices.

No. 125, inc
No. 120,
D

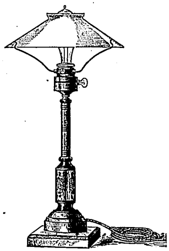


No. 125.

PORTABLE LAMP.



No. 105.



No. 120.

PORTABLE LAMP.

ORNAMENTAL STORE OR WINDOW PENDANT.

Length, 60 in. Spread, 50 in. For Six or more Lights.

		Polished Brass.	Gold Bronze.
No. 125, including Key Socket,	Price	$7 00	$7 50
No. 120, " "	"	6 00	6 35

Double Flexible Conducting Cord, per ft., Worsted, 10c.; Silk, 12c.

No. 105, 6 Lights, including Key Sockets, Polished Brass, . . . Price $57 00
6 " " " Gold Bronze, . . . " 60 50

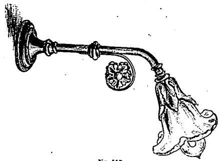
Globes, Shades, or Holders are not included in above prices.

No. 110.

ORNAMENTAL BRACKET.

Length, 10 in.

Polished Brass, including Key Socket,	Price	$4 50
Gold Bronze, " "	"	4 75

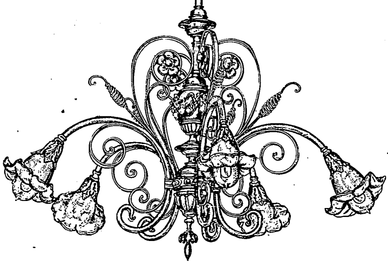


No. 115.

ORNAMENTAL BRACKET.

Length, 12 in.

Polished Brass, including Key Socket,	Price	$5 00
Gold Bronze, " "	"	5 25



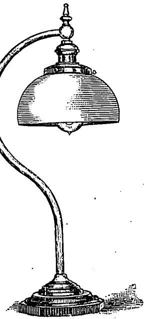
No. 170.

ORNAMENTAL ELECTROLIER.

Length, 48 in. Spread, 30 in.

		Polished Brass.	Gold Bronze.
3 Lights, including Key Sockets,	Price	$60 00	$65 00
4 " " "	"	75 00	82 00
5 " " "	"	88 00	97 00
6 " " "	"	100 00	110 00

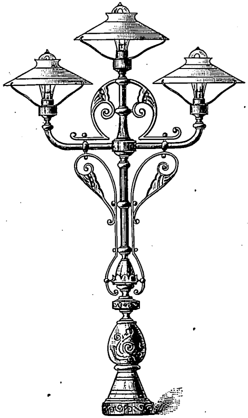
Glass Flowers and Holders not included in above prices.



No. 573.

PORTABLE DESK LAMP.

Bronzed, including Key Sockets, .	Price	$3 00
Pol'd Brass, " " . .	"	4 00
Gold Bronze, " " .	"	4 25



No. 580.

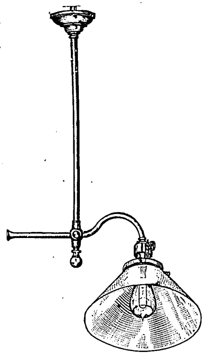
ORNAMENTAL NEWELL.

Height, 36 in. Spread, 14 in.

		Pol'd Brass.	Gold Bronze.
2 Lights and Centre Light,	Price	$28 00	$31 00
3 " "	"	33 50	38 00
4 " "	"	38 50	44 00

Including Sockets with Keys.

Globes, Shades, or Holders not included in above prices.



No. 584. Patented.

SLIDING PENDANT.

Having both Lateral and Vertical Adjustment.

Pol'd Brass, including Key Socket, .	Price	$8 00
Gold Bronze, " " . . .	"	8 50

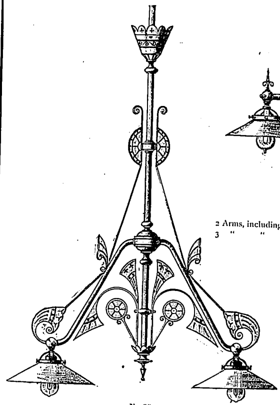
No. 170.

ORNAMENTAL ELECTROLIER.

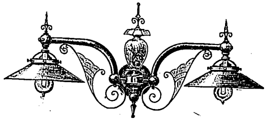
Length, 48 in. Spread, 30 in.

		Polished Brass.	Gold Bronze.
3 Lights, including Key Sockets,	Price	$60 00	$65 00
4 " "	"	75 00	82 00
5 " "	"	88 00	97 00
6 " "	"	100 00	110 00

Glass Flowers and Holders not included in above prices.



No. 29.

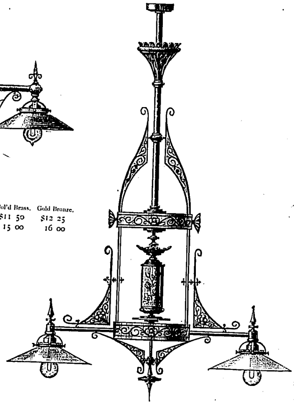


No. 365.

ORNAMENTAL BRACKET.

Spread, 15 in.

		Pol'd Brass.	Gold Bronze.
2 Arms, including Key Sockets,	Price	$11 50	$12 25
3 " " "	"	15 00	16 00



No. 31.

ORNAMENTAL ELECTROLIERS.

Length, 48 in. Spread, 24 in.

		Polished Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price	$27 50	$30 00
3 " " "	"	35 50	39 25
4 " " "	"	43 00	48 00
6 " " "	"	58 50	65 00

Length, 48 in. Spread, 28 in.

		Polished Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price	$33 50	$36 50
3 " " "	"	42 00	46 50
4 " " "	"	50 50	56 50
6 " " "	"	67 00	75 00

Shades or Holders are not included in above prices.

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ORNAMENT

Height, 52 in.

2 Lights and Centre Li

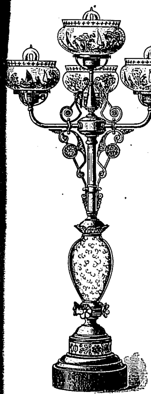
3 " "

4 " "

Including

nd, 28 in.

	Polished Brass.	Gold Bronze.
e	$33 50	$36 50
	42 00	46 50
	50 50	56 50
	67 00	75 00



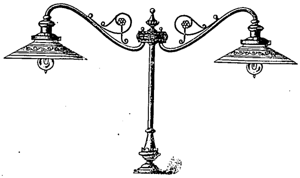
No. 950.

ORNAMENTAL NEWELL.

Height, 52 in. Spread, 18 in.

	Pol'd Brass.	Gold Bronze.
Lights and Centre Light,	$34 00	$36 50
" "	39 50	42 50
" "	45 00	49 00

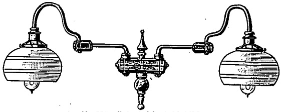
Including Key Sockets.



No. 145. Patented Sept. 24, 1878.

SWINGING DESK STAND LIGHT.

Height, 18 in. Spread, 24 in.

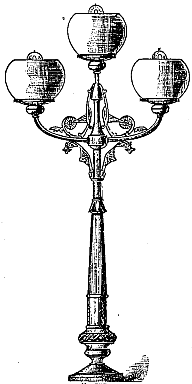


No. 590. Patented Sept. 24, 1878.

TWO-LIGHT SWINGING BRACKET.

		Bronzed.	Polished Brass.	Gold Bronze.
No. 145, 2 Light Single Swing,	Price,	$8 50	$12 00	$12 50
2 " Double "	"	12 50	16 75	17 50
1 " Single "	"	5 00	7 50	7 85
1 " Double "	"	7 00	10 00	10 50
No. 590, 2 " Single "	"	6 50	8 50	8 85
2 " Double "	"	10 50	13 25	13 75

Including Key Sockets.



No. 595.

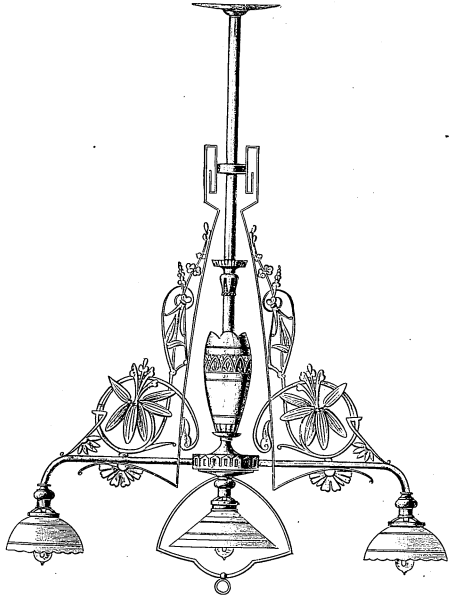
ORNAMENTAL NEWELL.

Height, 40 in. Spread, 15 in.

	Pol. Brass.	Gold Bronze.
2 Lights and Centre Light,	$20 00	$22 00
3 " "	24 50	27 00
4 " "	29 00	32 00

Including Key Sockets.

Globes, Shades or Holders are not included in above prices.



No. 1300. Patented Aug. 8, 1882.

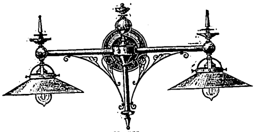
ORNAMENTAL SLIDE ELECTROLIER.

Length, 50 in. Spread, 30 in.

		Pol'd Brass.	Gold Br'ze.
3 Lights, including Slide, . .	Price	$50 00	$55 00
4 " " " . . .	"	62 00	69 50
5 " " " . . .	"	74 00	84 00
7 " " " . . .	"	85 00	97 50

		Pol'd Brass.	Gold Br'ze.
2 Lights, without Slide, . .	Price	$40 00	$45 00
3 " " " . . .	"	52 00	59 50
4 " " " . . .	"	64 00	74 00
6 " " " . . .	"	75 00	87 50

Globes, Shades or Holders are not included in above prices.

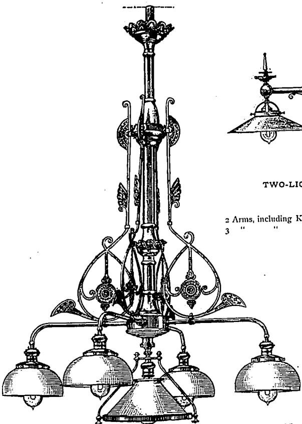


No. 360.

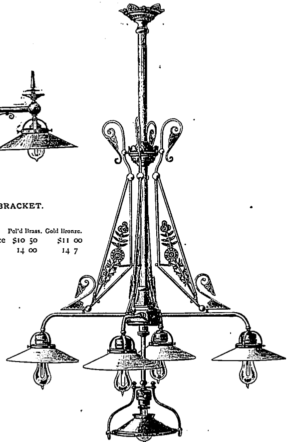
TWO-LIGHT ORNAMENTAL BRACKET.

Spread, 15 in.

		Pol'd Brass.	Gold Bronze.
2 Arms, including Key Socket, . .	Price	$10 50	$11 00
3 " " " . .	"	14 00	14 7



No. 205.



No. 700.

ORNAMENTAL SLIDE ELECTROLIERS.

Patented Aug. 8, 1882.

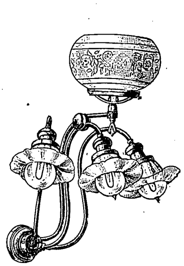
No. 205. Length, 48 in. Spread, 28 in.

		Pol'd Brass.	Gold Bronze.
3 Lights, with Slide, including Key Sockets, ...	Price	$33 00	$35 50
5 " " " "	"	48 50	53 50
7 " " " "	"	62 50	70 00
2 " without Slide, " "	"	23 00	25 50
4 " " " "	"	38 50	43 50
6 " " " "	"	52 50	60 00

No. 700. Length, 48 in. Spread, 28 in.

		Pol'd Brass.	Gold Bronze.
3 Lights, with Slide, including Key Sockets, . . .	Price,	$35 50	$38 00
5 " " " "	"	53 50	58 50
7 " " " "	"	70 00	77 50
2 " without Slide, " "	"	25 50	28 00
4 " " " "	"	43 50	48 50
6 " " " "	"	60 00	67 50

Globes, Shades or Holders are not included in above prices.



No. 780.

Patented April 18, 1882, and Aug. 8, 1882.

THREE-LIGHT COMBINATION ELECTRIC LIGHT AND GAS BRACKET.

Spread, 15 in.

		Pol'd Brass.	Gold Bronze.
3 Lights and Centre Gas Light,	Price	\$10 50	\$11 00
2 " " "	"	8 50	8 90
3 " for Electric Light only,	"	8 50	8 80
2 " " " "	"	6 25	6 50

Including Key Sockets.

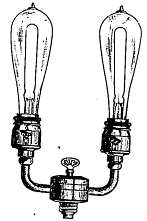
No. 783.

FOUR-LIGHT BOUQUET STANDARD.

Height, 25 in.

Polished Brass, including Key Sockets,	Price	\$160 00
Gold Bronze, " "	"	170 00

Glass Flowers or Globes are not included in above prices.



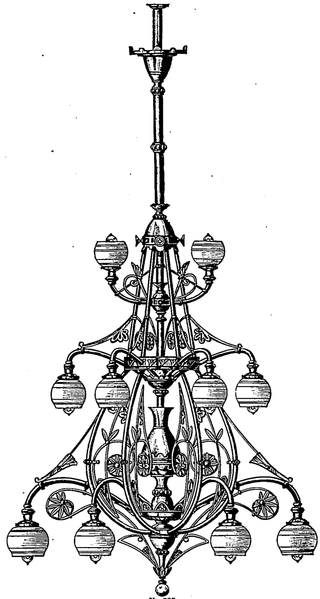
No. 790.

TWO-LIGHT ATTACHMENT FOR NIGHT LIGHTS.

Will fit any Socket.

Polished Brass, including Key Sockets,	Price	\$4 50
Gold Bronze, " "	"	4 75

This device permits of using either one or both lamps at the full candle power, or else the two lamps may, by means of the centre switch, be put in series, thus bringing them down to a red glow.



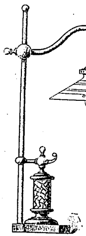
No. 325.

ORNAMENTAL ELECTROLIER.

Length, 132 in. Spread, 60 in.

	Upper Tier.	Middle Tier.	Lower Tier.		Polished Brass.	Gold Bronze.
21 Lights, consisting of	3	6	12	Price	$450 00	$500 00
18 " "	0	6	12	"	430 00	475 00
12 " "	0	0	12	"	390 00	425 00
20 " "	4	8	8	"	400 00	425 00
16 " "	0	8	8	"	380 00	405 00
12 " "	0	4	8	"	360 00	380 00

Above prices include Sockets without Keys, but no Globes or Holders.

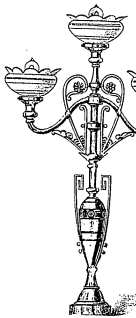


No. 140.

ADJUSTABLE STUDENT LAMP.

Patented.

Polished Brass, including Key Socket,	Price	$8 50
Gold Bronze, " "	"	9 00



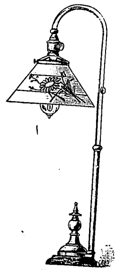
No. 610.

ORNAMENTAL NEWELL.

Height, 36 in. Spread, 16 in.

		Pol'd Brass.	Gold Br'ze.
2 Lights and Centre Light,	Price	$27 00	$30 00
3 " "	"	32 50	37 00
4 " "	"	37 50	43 00

Including Sockets with Keys.



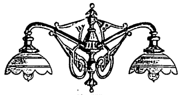
No. 615.

ADJUSTABLE STUDENT LAMP.

Patented.

Polished Brass, including Key Socket,	Price	$8 00
Gold Bronze, " "	"	8 35

Above prices do not include Globes, Shades or Holders.

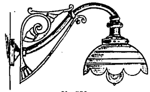


No. 385.

ORNAMENTAL BRACKET.

Spread, 15 in.

	Pol'd Brass.	Gold Bronze.
2 Arms, including Key Sockets,	$14 00	$14 75
3 " " "	17 50	18 50

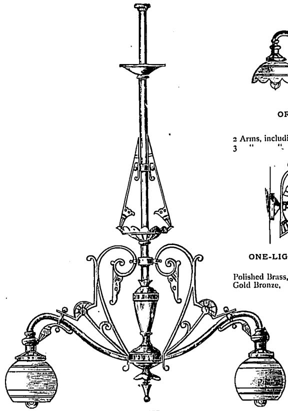


No. 390.

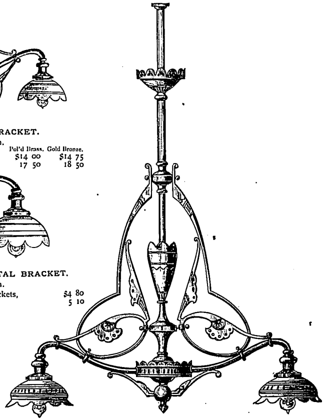
ONE-LIGHT ORNAMENTAL BRACKET.

Length, 12 in.

Polished Brass, including Key Sockets,	$4 80
Gold Bronze, " "	5 10



No. 395.



No. 420.

ORNAMENTAL ELECTROLIERS.

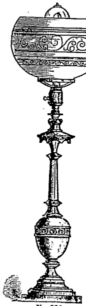
No. 395. Length, 42 in. Spread, 24 in.

		Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price	$29 50	$33 00
3 " " "	"	38 50	43 50
4 " " "	"	47 50	53 50
6 " " "	"	63 50	72 00

No. 420. Length, 24 in. Spread, 26 in.

		Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price	$28 50	$31 00
3 " " "	"	36 50	40 00
5 " " "	"	44 00	49 50
6 " " "	"	60 00	67 00

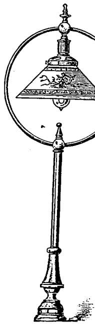
Shades, Globes or Holders are not included in above prices.



No. 220.

PORTABLE DESK LAMP.

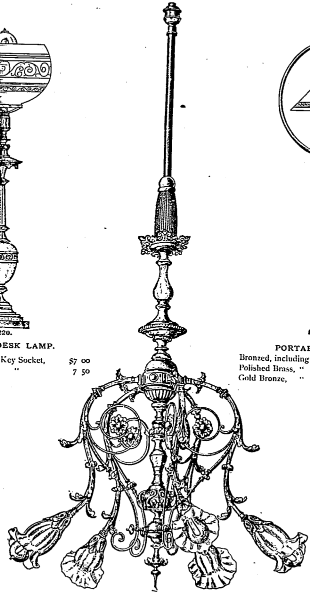
Polished Brass, including Key Socket,	$7 00
Gold Bronze, " "	7 50



No. 225.

PORTABLE DESK LAMP.

Bronzed, including Key Socket, .	$6 00
Polished Brass, " " . .	7 00
Gold Bronze, " " .	7 40



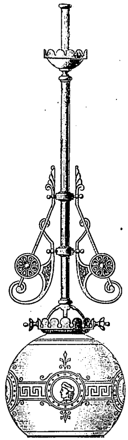
No. 230.

ORNAMENTAL ELECTROLIER.

Length, 54 in. Spread, 26 in.

		Pol'd Brass.	Gold Bronze.
4 Lights, including Key Sockets,	Price	$90 00	$95 00
5 " " "	"	115 00	122 00
6 " " "	"	135 00	144 00

Glass Flowers, Globes, Shades or Holders not included in above prices.



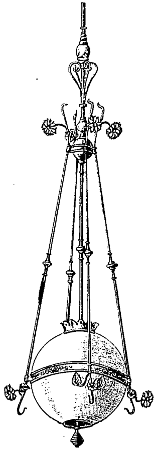
No. 800.

ORNAMENTAL HALL LIGHT.

Length, 42 in.

	Pol'd Brass.	Gold Br'ze.
1 Light, with 10 in. Etched Globe,	$13 00	$14 00
1 " " 12 in. "	15 00	16 00

Including Socket without Key.



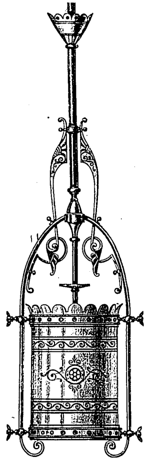
No. 553.

TWELVE-INCH ORNAMENTAL GLOBE LAMP.

With Beaten Brass Pinks, etc.

3 Lights, ... Price $75 00

Including Sockets without Keys.



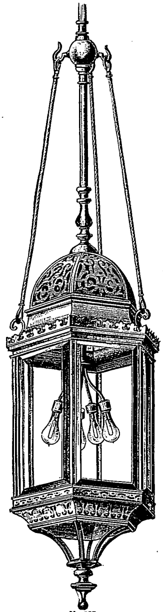
No. 850

ORNAMENTAL HALL LAMP.

Length, 48 in.

1 Light, Polished Brass. . . . Price $20 00
1 " Gold Bronze, ... " 22 00

Including Socket without Key.



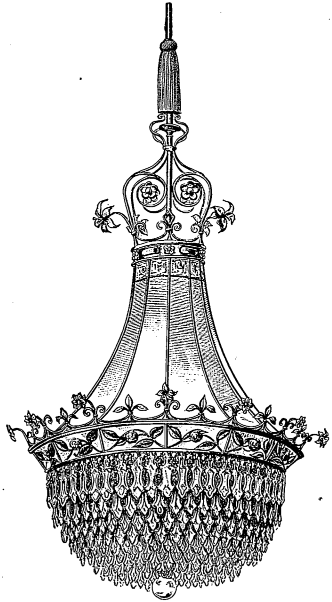
No. 565.

MOORISH LANTERN.

Length, 60 in. Diameter, 15 in.

With 1 Three-Light Cluster,	Price	$120 00
2 " "	"	125 00

Including Sockets without Keys.



No. 570.

SUNLIGHT.

Length, 80 in. Spread, 36 in. Opal Panels, Brass Flowers, and Crystal Basket,

With 12 Light Cluster, including Sockets without Keys,	$300 00
15 " " " " "	305 00
18 " " " " "	310 00

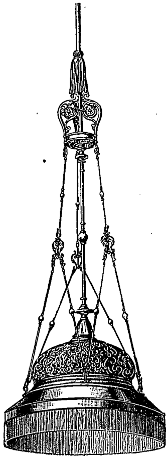
No. 525.

ORNAMENTAL SCONCE.

Size, 29 x 24 in.

Polished Brass Oval Repoussé Frame, Beveled Glass Mirror, with Bracket for 2 Lamps, mounted on Peacock Blue Plush.

Price, including Sockets and Glass Flowers, $125 00



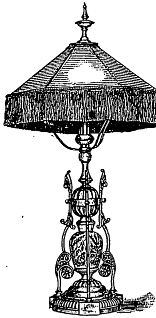
No. 530.

ORNAMENTAL HALL LIGHT.

Open Repoussé Work Metal Dome, with Silk Fringe.

Length, 60 in. Diameter at Fringe, 22 in.

Four-Light Cluster, with Key Sockets, Price $240 00

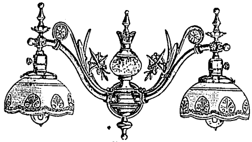


No. 535.

ORNAMENTAL READING LAMP.

With Crimson Silk Shade and Fringe.

	Pol'd Brass.	Gold Bronze.
Key Socket, Shade and Holder,	$24 00	$25 00



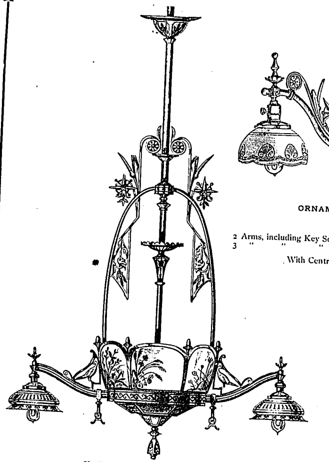
No. 40.

ORNAMENTAL BRACKET.

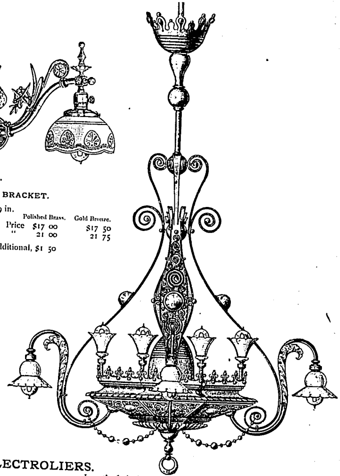
Spread, 19 in.

		Polished Brass.	Gold Bronze.
2 Arms, including Key Socket,	Price	$17 00	$17 50
3 " " "	"	21 00	21 75

With Centre Light, additional, $1 50



No. 750. Patented April 18, and Aug. 8, 1882.



ORNAMENTAL ELECTROLIERS.

Length, 60 in. Spread, 36 in.

For Electric Light and Gas in Combination, or Electric Light only.

		Pol'd Brass.	Gold Bronze.
For both Electric Light and Gas, including Key Sockets,	Price	$200 00	$215 00
For Electric Light only,	"	175 00	185 00

Six outside Lights and three inside.

Length, 60 in. No. 45. Spread, 36 in.

Including Sockets with Keys.

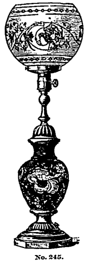
16 Lights, { 8 Lights in Upper Tier, / 8 " Lower " }	Polished Brass,	Price	$400 00
	Gold Bronze,	"	435 00

Globes, Shades or Holders not included in above prices.

No. 240.

ORNAMENTAL PORTABLE.

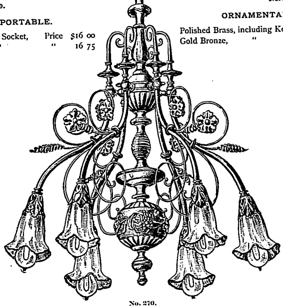
Polished Brass, including Key Socket,	Price	$16 00
Gold Bronze, " "	"	16 75



No. 245.

ORNAMENTAL PORTABLE.

Polished Brass, including Key Socket,	Price	$14 50
Gold Bronze, " "	"	15 00



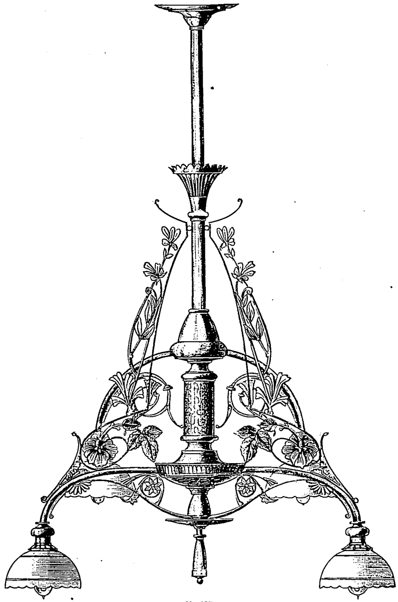
No. 270.

ORNAMENTAL ELECTROLIER.

Length, 52 in. Spread, 24 in.

		Polished Brass.	Gold Bronze.
3 Lights, including Key Sockets,	Price	$45 00	$50 00
4 " " "	"	55 00	61 50
5 " " "	"	65 00	73 00
6 " " "	"	75 00	85 00

Glass Flowers, Globes, Shades, or Holders not included in above prices.



No. 285.

ORNAMENTAL ELECTROLIER.

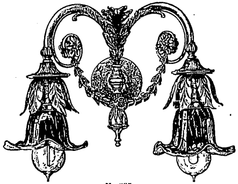
Length, 70 in. Spread, 36 in.

	Upper Tier.	Lower Tier.			Polished Brass.	Gold Bronze.
9 Lights,	3	6	including Key Sockets,	Price	$120 00	$135 00
12 "	6	6	" "	"	150 00	170 00
10 "	5	5	" "	"	125 00	140 00
6 "	0	6	" "	"	100 00	112 50

Globes, Shades, or Holders not included in above prices.

Length, 76 in. Spread, 36 in.					
	Upper Tier.	Lower Tier.		Polished Brass.	Gold Bronze.
9 Lights,	3	6	including Key Sockets,	Price $120 00	$135 00
12 "	6	6	" "	" 150 00	170 00
10 "	5	5	" "	" 125 00	140 00
6 "	0	6	" "	" 100 00	112 50

Globes, Shades, or Holders not included in above prices.

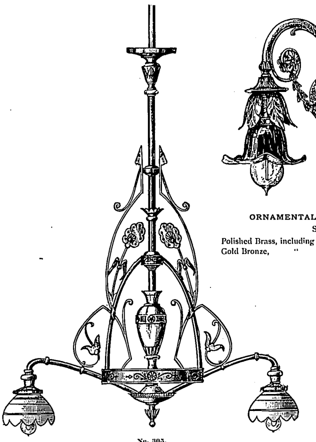


No. 205.

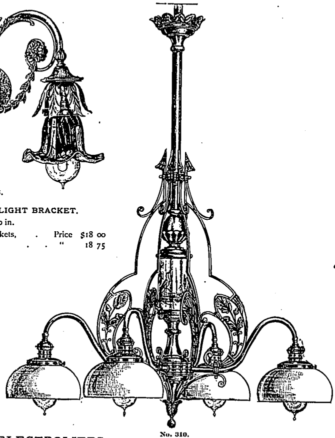
ORNAMENTAL TWO-LIGHT BRACKET.

Spread, 10 in.

Polished Brass, including Key Sockets,	Price	$18 00
Gold Bronze, " "	"	18 75



No. 305.



No. 310.

ORNAMENTAL ELECTROLIERS.

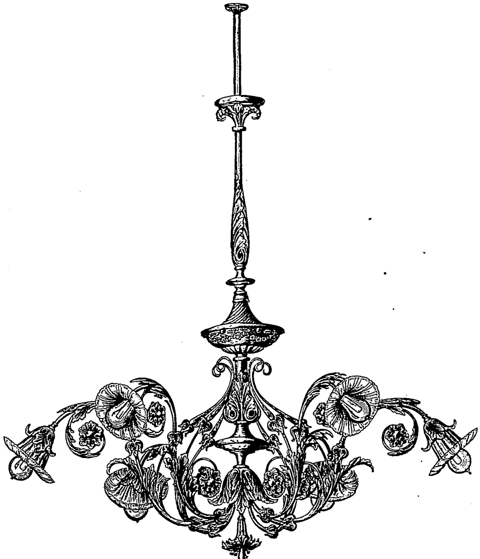
Length, 48 in. Spread, 30 in.

		Polished Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price	$38 00	$41 50
3 " " "	"	47 00	52 00
4 " " "	"	56 00	62 00
6 " " "	"	75 00	82 00

Length, 44 in. Spread, 25 in.

		Polished Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price	$31 00	$33 50
3 " " "	"	38 00	41 50
4 " " "	"	45 00	49 50
6 " " "	"	60 00	65 00

Glass Flowers, Globes, or Holders not included in above prices.



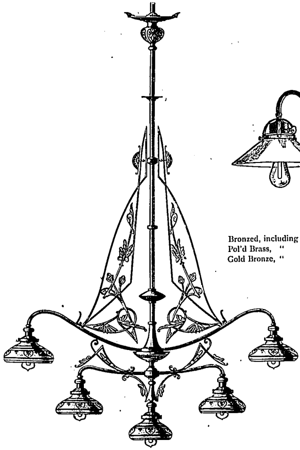
No. 200.

ORNAMENTAL FLORAL ELECTROLIER.

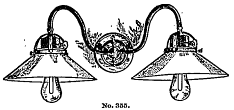
Length, 48 in. Spread, 30 in.

		Polished Brass.	Gold Bronze.
5 Lights, including Key Sockets,	Price	$175 00	$195 00
6 " " "	"	200 00	225 00
7 " " "	"	225 00	255 00
8 " " "	"	250 00	285 00

Glass Flowers or Holders not included in above prices.



No. 550.

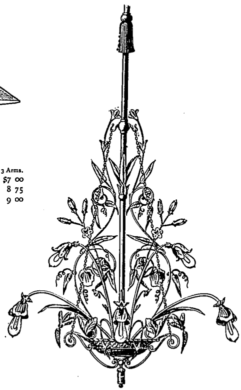


No. 355.

PLAIN BRACKET.

Spread, 12½ in.

		2 Arms.	3 Arms.
Bronzed, including Key Socket,	Price	$5 00	$7 00
Pol'd Brass, " "	"	6 25	8 75
Gold Bronze, " "	"	6 50	9 00



No. 600.

ORNAMENTAL ELECTROLIERS.

No. 550. Length, 60 in. Spread, 28 to 32 in.

		Pol'd Brass.	Gold Bronze.
9 Lights, including Centre Light, Spread 28 in.,	Price	$65 00	$73 00
10 " without " " 30 "	"	78 50	88 50
11 " including " " 30 "	"	79 50	89 50
12 " without " " 32 "	"	92 00	104 00
13 " including " " 32 "	"	93 00	105 00

Including Key Sockets. Above prices do not include Globes, Shades or Holders.

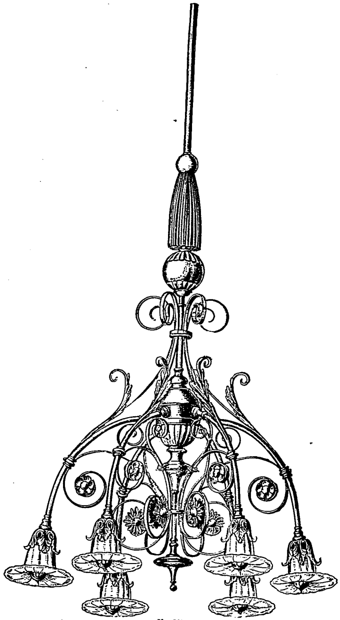
No. 600. Length, 64 in. Spread, 40 in.

		Pol'd Brass.	Gold Bronze.
8 Lights, including No-key Sockets,	Price	$170 00	$185 00
9 " " "	"	175 00	190 00
10 " " "	"	190 00	205 00
12 " " "	"	210 00	230 00

Above prices do not include Globes, Shades, or Holders.

		Polished Brass.	Gold Bronze.
5 Lights, including Key Sockets,	Price	$175 00	$195 00
6 " "	"	200 00	225 00
7 " "	"	225 00	255 00
8 " "	"	250 00	285 00

Glass Flowers or Holders not included in above prices.



No. 315.

ORNAMENTAL ELECTROLIER.

Length, 54 in. Spread, 25 in.

		Polished Brass.	Gold Bronze.
3 Lights, including Key Sockets,	Price	$60 00	$68 00
4 " " "	"	80 00	90 00
5 " " "	"	95 00	107 50
6 " " "	"	110 00	125 00

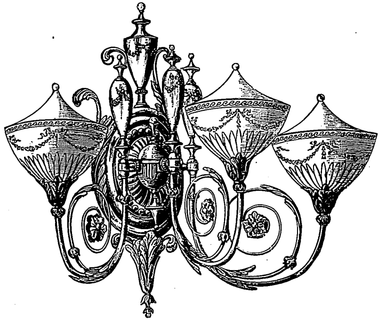
Glass Flowers or Holders not included in above prices.

ORNAMENTAL ELECTROLIER.

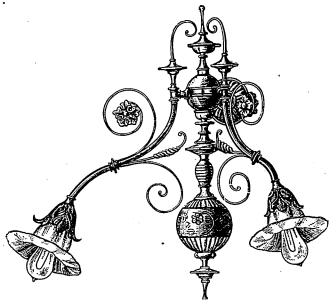
Length, 54 in. Spread, 25 in.

		Polished Brass.	Gold Bronze.
3 Lights, including Key Sockets,	Price	$60 00	$68 00
4 " " "	"	80 00	90 00
5 " " "	"	95 00	107 50
6 " " "	"	110 00	125 00

Glass Flowers or Holders not included in above prices.



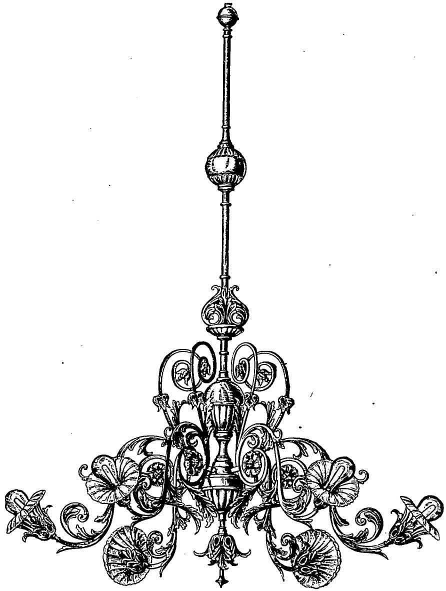
No. 540. ORNAMENTAL BRACKET. Spread, 18 in.



No. 545. ORNAMENTAL BRACKET. Spread, 18 in.

	Pol'd Brass.	Gold Br'ze.
No. 540, 2 Arms, including Key Sockets,	$65 00	$75 00
3 " " "	80 00	90 00
No. 545, 2 Arms, including Key Sockets,	$22 00	$24 50
3 " " "	32 00	36 00

Glass Flowers, Globes, or Holders not included in above prices.



No. 320.

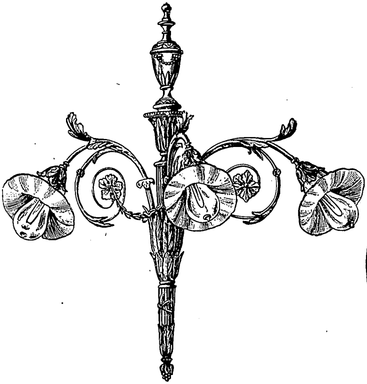
ORNAMENTAL FLORAL ELECTROLIER.

Length, 54 in. Spread, 40 in.

		Polished Brass.	Gold Bronze.
5 Lights, including Key Sockets,	Price	$200 00	$220 00
6 " " "	"	225 00	250 00
7 " " "	"	250 00	280 00
8 " " "	"	275 00	310 00

Glass Flowers or Holders not included in above prices.

2 Arms, includ
3 " "



No. 375.

No. 380

ORNAMENTAL FLORAL BRACKETS.

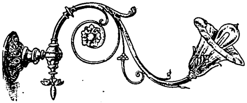
Spread, 18 in.

		Polished Brass.	Gold Bronze.
2 Arms, including Key Sockets,	Price	$85 00	$90 00
3 " " "	"	100 00	107 50

Spread, 18 in.

		Polished Brass.	Gold Bronze.
2 Arms, including Key Sockets,	Price	$65 00	$70 00
3 " " "	"	80 00	87 50

Glass Flowers or Holders are not included in above prices.

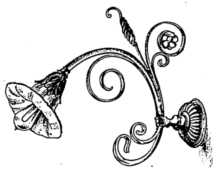


No. 510.

ORNAMENTAL BRACKET.

Length, 18 in.

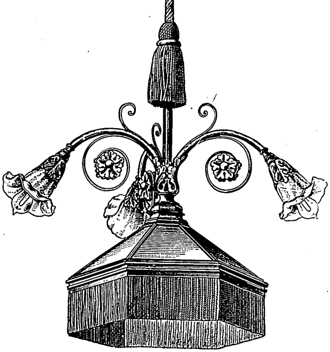
		1 Light.	2 Lights.
Polished Brass, including Key Sockets,	Price	$13 00	$25 00
Gold Bronze, " "	"	14 00	26 50



No. 515.

ORNAMENTAL ONE-LIGHT BRACKET.

Polished Brass, including Key Sockets,	Price	$10 00
Gold Bronze, " "	"	11 00



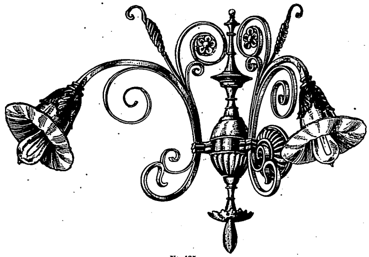
No. 520.

ORNAMENTAL ELECTROLIER, WITH 16-IN. OPAL SHADE.

Length, 60 in. Spread, 30 in.

		Polished Brass.	Gold Bronze.
3 Arms, with 3-Light Cluster inside of Shade, including Key Sockets,	Price	$70 00	$75 00
6 " " " " " "	"	88 00	95 00

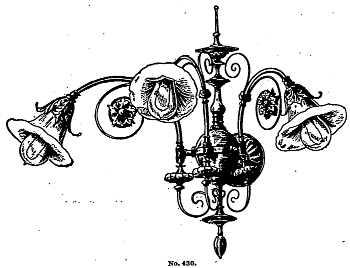
Glass Flowers or Holders not included in above prices.



No. 425.

ORNAMENTAL BRACKET.

Spread, 20 in.



No. 430.

ORNAMENTAL BRACKET.

Spread, 20 in.

	Pol'd Brass.	Gold Br'ze.
No. 425, 2 Arms, including Key Sockets,	$24 00	$26 50
3 " " "	34 00	37 50
No. 430, 2 Arms, including Key Sockets,	$20 00	$22 50
3 " " "	28 00	31 50

Glass Flowers and Holders not included in above prices.

No. 73.

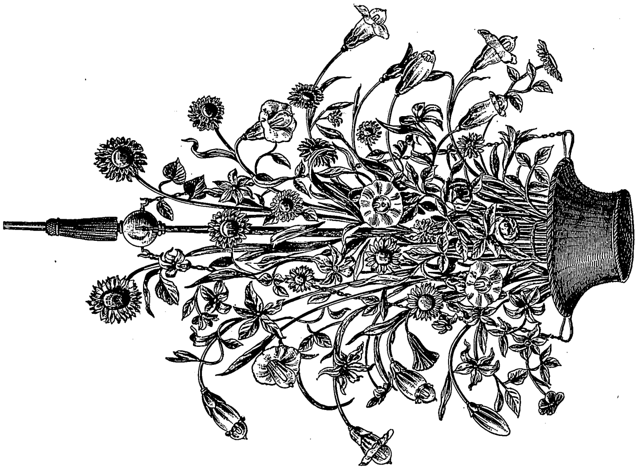
ORNAMENTAL FLORAL ELECTROLIER.

					Polished Brass.	Gold Bronze.
20 Lights	—Length, 84 in.;	Spread, 54 in.	—including No-key Sockets,	Price	$350 00	$375 00
14 "	" 84 "	" 50 "	" "	"	250 00	275 00
12 "	" 64 "	" 36 "	" "	"	200 00	220 00
8 "	" 64 "	" 36 "	" "	"	175 00	195 00

Glass Flowers or Holders not included in above prices.

14 " "	84 " "	50 " "	230 00	275 00
12 " "	64 " "	36 " "	200 00	220 00
8 " "	64 " "	36 " "	175 00	195 00

Glass Flowers or Holders not included in above prices.



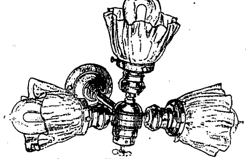
No. 35.

ORNAMENTAL FLORAL ELECTROLIER.

Length, 72 in. Spread, 54 in.

		Polished Brass.	Gold Bronze.
24 Lights, including No-key Sockets,	Price	$600 00	$635 00

Above prices do not include Glass Flowers or Holders.

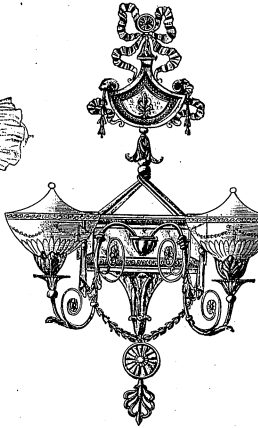


No. 330.

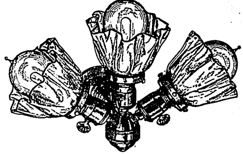
THREE-LIGHT BRACKET.

With Central Switch.

Spread to tips of Lamps, 16 in.



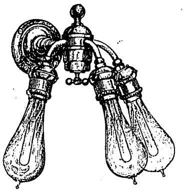
No. 370.



No. 335.

THREE-LIGHT BRACKET.

Spread to tips of Lamps, 14 in.



No. 340.

THREE-LIGHT BRACKET.

With Central Switch.

Spread to tips of Lamps, 10 in.

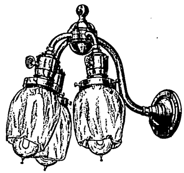
	Bronzed.	Pol'd Brass.	Gold Bronze.
No. 330, including No-key Sockets,	$5 50	$6 75	$7 25
340, " "	6 00	7 25	7 75

ORNAMENTAL BRACKET.

Height, 24 in. Spread, 12 in.

	Pol'd Brass.	Gold Bronze.
2 Arms, including Key Sockets, Price	$80 00	$84 00
3 " " " "	90 00	95 00

Glass Flowers, Globes, or Holders not included in above prices.



No. 345.

THREE-LIGHT BRACKET.

Spread to tips of Lamps, 10 in.

	Bronzed.	Pol'd Brass.	Gold Bronze.
No. 335, including Key Sockets,	$4 50	$5 75	$6 25
345, " "	5 00	6 25	6 75

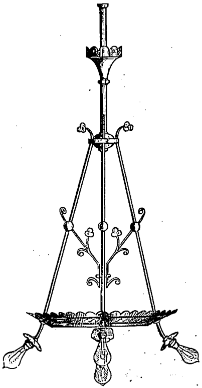
KET.

14 in.

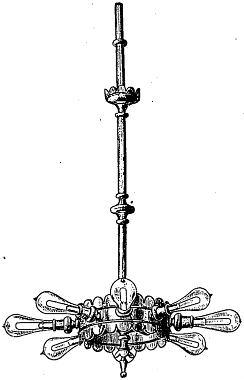
KET.

10 in.

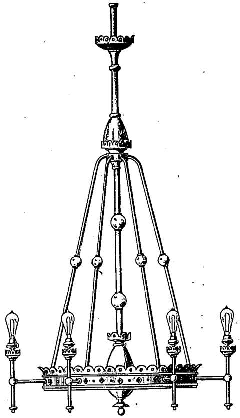
nzed.	Pol'd Brass.	Gold Bronze.
4 50	$5 75	$6 25
5 00	6 25	6 75



No. 470.



No. 475.



No. 480.

ORNAMENTAL ELECTROLIERS.

Length, 45 in. Spread, 22 in.

		Pol'd Brass.	Gold Bronze.
3 Arms and Centre Light,	Price	$24 50	$26 00
4 " "	"	29 00	31 00
5 " "	"	33 50	36 00
6 " "	"	38 00	41 00

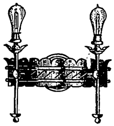
Including Key Sockets.

Length, 48 in. Diameter of Band, 12 in. Spread, 26 in.

		Pol'd Brass.	Gold Bronze.
4 Lights, including Key Sockets,	Price	$18 00	$19 50
6 " " "	"	22 00	24 00
8 " " "	"	26 00	28 50

Length, 48 in. Spread, 26 in.

		Pol'd Brass.	Gold Bronze.
3 Lights, including Key Sockets,	Price	$30 00	$32 50
4 " " "	"	36 00	39 50
5 " " "	"	42 00	46 50
6 " " "	"	48 00	53 50

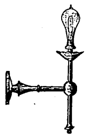


No. 455.

TWO-LIGHT BRACKET.

Spread, 12 in.

Polished Brass, including Key Sockets,	Price	$12 00
Gold Bronze, " "	"	13 00

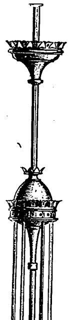
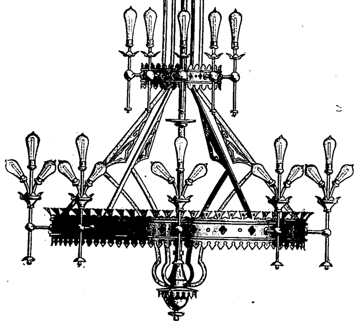


No. 460.

ONE-LIGHT BRACKET.

Length, 12 in.

Polished Brass, including Key Socket,	Price	$4 00
Gold Bronze, " "	"	4 25

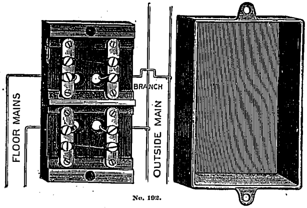



No. 465.

Length, 144 in. **ORNAMENTAL ELECTROLIER.** Spread, 72 in.

	Colors and Gilt.	Pol'd Brass.	Gold Bronze.
40 Lights, 32 Lights on Lower Tier of 8 Arms, 8 Lights on Upper Tier of 8 Arms, including No-key Sockets,	$270 00	$335 00	$365 00
32 " 24 " " 8 " 8 " " 8 " " "	255 00	320 00	345 00
24 " on Lower Tier of 8 Arms only, ...	235 00	300 00	320 00
32 " " 8 " "	250 00	315 00	340 00

The number of Arms or Lights on Clusters can be changed to order.

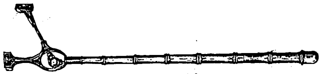


No. 102.

SPECIAL FLOOR CUT-OUT,

For Concealed Work. Patented May 2 and Sept. 12, 1882.

The above represents a safety cut-out to be used for concealed work. It is placed under the flooring where the main wires enter the room and a pocket arranged so that it may be readily accessible. This cut-out is useful for testing purposes as well as on account of its safety catch. It will be seen that both poles can be disconnected and the trouble easily located. Price, with Cap, $1 30.

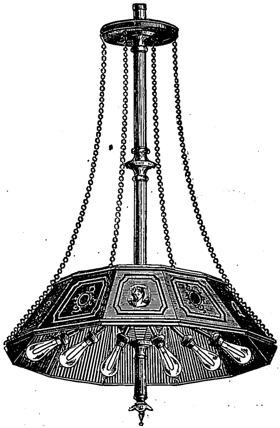


No. 630. Patented.

PATENT SOCKET KEY TURNER.

Length, 60 in. . . . . Price $4 00

To order, of any length desired.

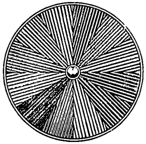


No. 635.

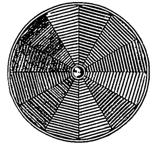
PATENT SILVERED CORRUGATED GLASS CONE REFLECTOR.

		Plain Bronze.	Orna. as in cut.
18 in. Reflector, 4 Lights,	Price	$18 00	$22 00
22 " " 4 "	"	22 00	26 00
25 " " 6 "	"	28 00	33 00
30 " " 8 "	"	35 00	42 00
35 " " 10 "	"	44 00	54 00
40 " " 12 "	"	55 00	70 00
50 in. Reflector, 16 Lights,	Price	$70 00	$90 00
60 " " 24 "	"	90 00	120 00
72 " " 36 "	"	125 00	165 00
84 " " 52 "	"	175 00	225 00
96 " " 72 "	"	250 00	300 00

Prices include Sockets without Keys.



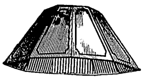
No. 640.



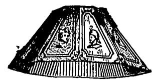
No. 645.

PATENT SILVERED GLASS REFLECTING CONCAVES.

PATENT SILVERED GLASS REFLECTING CONCAVES.

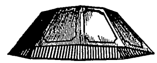


No. 655.



No. 660.

No. 665.



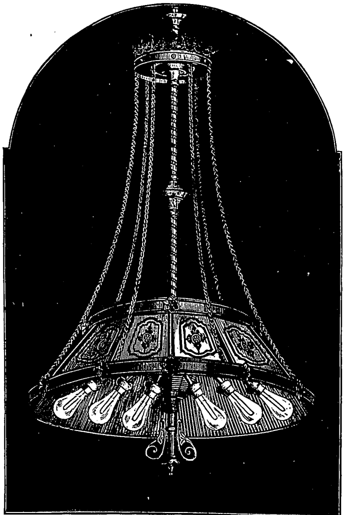
No. 670.

PATENT SILVERED GLASS REFLECTING SHADES.

PATENT SILVERED GLASS REFLECTING SHADES.

		No. 640.	No. 645.
6 in. Concave, Plain Bronzed,	Price	$0 65	$0 75
8 " " "	"	1 00	1 25
10 " " "	"	1 65	2 00
12 " " "	"	2 65	3 00

		Pla.Br.	Br.&St.	Ex.Or.
No. 655,	10 in. Octagon Reflecting Shade,	$2 75	$3 25	$4 50
No. 660,	12 " " " "	3 50	4 00	5 50
No. 665,	14 " " " "	5 00	5 50	8 25
No. 670,	16 " " " "	6 75	7 50	9 50
	18 " " " "	8 50	10 00	13 50



No. 675.

No. 675.

EXTRA ORNAMENTAL PATENT SILVERED CORRUGATED GLASS REFLECTOR.

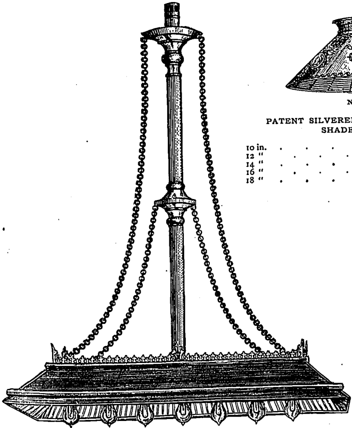
18 in. Reflector, 4 Lights,		Price	$28 00
22 " "	4 "	"	32 00
25 " "	6 "	"	38 00
30 " "	8 "	"	50 00
35 " "	10 "	"	65 00
40 " "	12 "	"	85 00
50 " "	16 "	"	110 00
60 " "	24 "	"	150 00
72 " "	36 "	"	210 00
84 " "	52 "	"	275 00
96 " "	72 "	"	350 00

These prices include No-key Sockets.

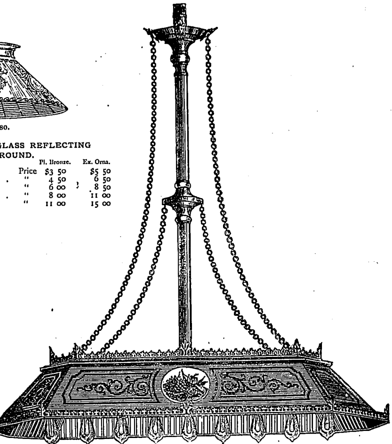
No. 680.

PATENT SILVERED GLASS REFLECTING SHADES, ROUND.

		Pl. Bronze.	Ex. Orna.
10 in.	Price	$3 50	$5 50
12 "	"	4 50	6 50
14 "	"	6 00	8 50
16 "	"	8 00	11 00
18 "	"	11 00	15 00



No. 685.



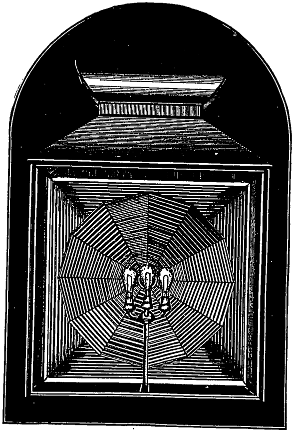
No. 690.

PATENT SILVERED CORRUGATED GLASS SHOW WINDOW REFLECTORS.

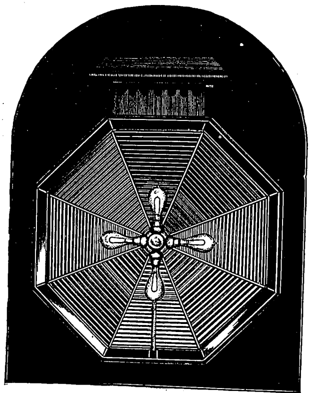
		Plain.	Ornamented.
24 in. Reflector, Square Ends, with 2 Lights,	Price	$12 50	$17 50
30 " " " 4 "	"	16 50	23 00
36 " " " 6 "	"	22 00	30 00
42 " " " 8 "	"	29 00	40 00
48 " " " 10 "	"	38 00	50 00

		Plain Bronzed.	Ornamented.	Ex.Or.as cut.
24 in. Reflector, Octagon Ends, with 2 Lights,	Price	$15 00	$20 00	$26 00
30 " " " 4 "	"	20 00	26 50	33 50
36 " " " 6 "	"	26 00	34 00	42 00
42 " " " 8 "	"	33 00	44 00	53 00
48 " " " 10 "	"	42 00	55 00	65 00

Above prices include No-key Sockets.



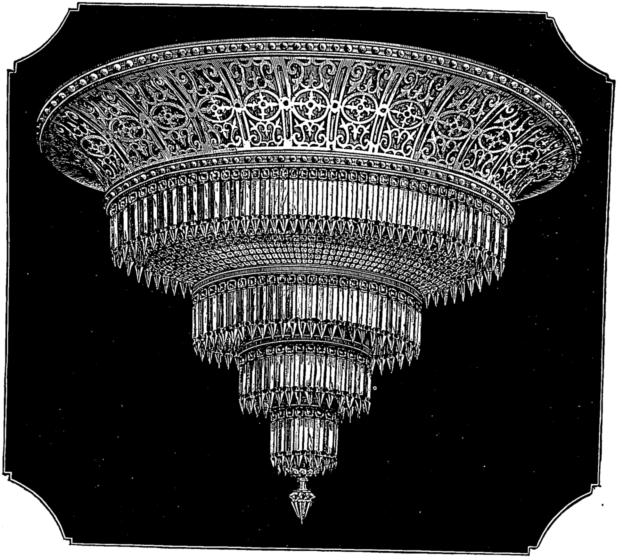
No. 695.



No. 705.

PATENT SILVERED GLASS REFLECTING HEADLIGHTS.

		No. 695.	No. 705.
15 in. Diameter, with Cluster of Four Lights, including Key Sockets,	Price	$25 00	$27 00
20 " " " " " "	"	30 00	32 50
24 " " " " " "	"	37 00	40 00



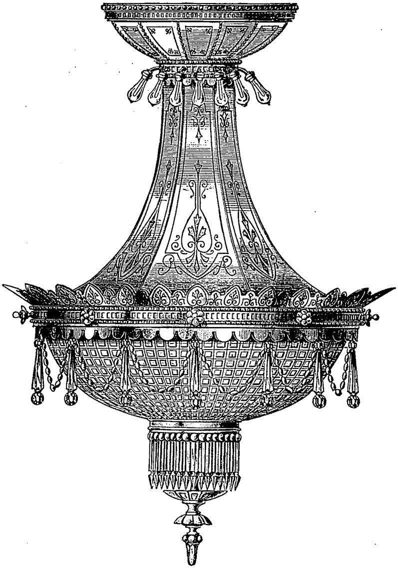
No. 710.

ORNAMENTAL REFLECTING SUNLIGHT,

TO BE INSERTED IN CEILING.

			Without Corona.	With Corona.
Sunlight with 25 in. Reflector, 6 Lights.			Price $65 00	$85 00
"	30 "	" 8 "	" 85 00	110 00
"	35 "	" 12 "	" 115 00	140 00
"	40 "	" 16 "	" 170 00	225 00
"	50 "	" 24 "	" 250 00	325 00
"	60 "	" 36 "	" 350 00	450 00
"	72 "	" 60 "	" 500 00	625 00
"	84 "	" 96 "	" 700 00	850 00
"	96 "	" 120 "	" 1000 00	1200 00

Above prices include No-key Sockets. For Suspended Coronas add 10 per cent. to above prices.



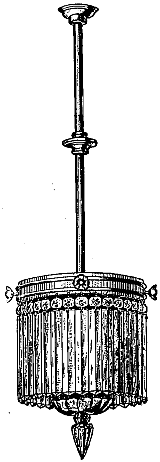
No. 715.

ORNAMENTAL REFLECTING SUNLIGHT.

SUSPENDED.

	NUMBER OF LIGHTS Around Canopy.	NUMBER OF LIGHTS Inside Reflector.	Price.
With 25 in. Reflector, Decorated in Colors,	6	6	$100 00
30 " " " "	6	8	125 00
35 " " " "	6	12	175 00
40 " " " "	8	16	250 00
50 " " " "	8	24	350 00
60 " " " "	12	36	500 00
72 " " " "	16	60	700 00

Above prices include No-key Sockets.



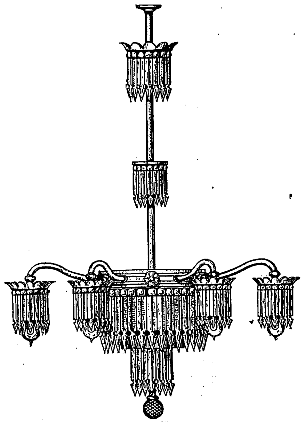
No. 730.

CRYSTAL HALL LIGHT.

Length, 45 in. Spread, 12 in.

With Three-Light Cluster inside.

Polished Brass, including No-key Sockets, Price	$24 00
Gold Bronze, " " "	25 50



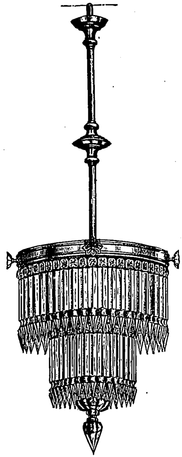
No. 725.

CRYSTAL ELECTROLIER.

Length, 48 in. Spread, 27 in.

	Pol'd Brass.	Gold Bronze.
With 2 Arms and 2 Lights inside,	$42 00	$45 00
4 " 2 " "	52 00	56 00
6 " 3 " "	65 00	70 00
8 " 4 " "	87 50	95 00

Including No-key Sockets.



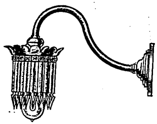
No. 735.

CRYSTAL HALL LIGHT.

Length, 48 in. Spread, 16 in.

With 2 Three-Light Clusters inside.

Polished Brass, including No-key Sockets, Price	$45 00
Gold Bronze, " " "	47 50

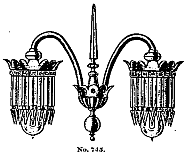


No. 740.

ONE-LIGHT CRYSTAL BRACKET.

Length, 12 in.

Polished Brass, including Key Sockets,	Price	$5 50
Gold Bronze, " "	"	5 75

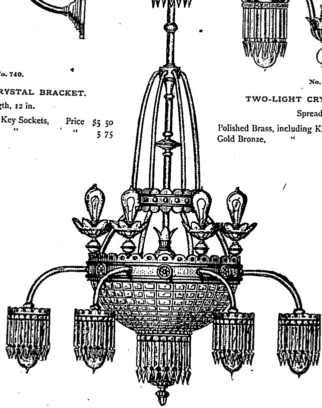


No. 745.

TWO-LIGHT CRYSTAL BRACKET.

Spread, 14 in.

Polished Brass, including Key Sockets,	Price	$14 00
Gold Bronze, " "	"	14 50



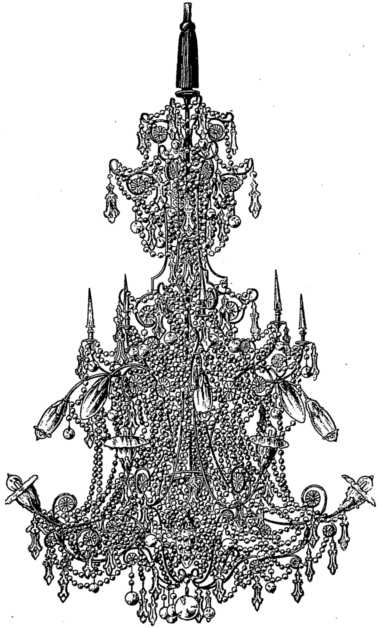
No. 755.

CRYSTAL ELECTROLIER.

Length, 64 in. Spread, 36 in.

	Number of Lights on— Arms.	Inside Basket.	Upper Tier.			Polished Brass.	Gold Bronze.
9 Lights,	6	3	None,	including Sockets without Keys,	Price	$90 00	$100 00
15 "	6	3	6	" " " "	"	115 00	125 00
12 "	8	4	None,	" " " "	"	110 00	125 00
20 "	8	4	8	" " " "	"	140 00	155 00

	Arms.	Inside Basket.	Upper Tier.			
9 Lights,	6	3	None,	including Sockets without Keys, . .	Price $90 00	$100 00
15 "	6	3	6	" " " " . . .	" 115 00	125 00
12 "	8	4	None,	" " " " . . .	" 110 00	125 00
20 "	8	4	8	" " " " . . .	" 140 00	155 00



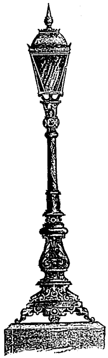
No. 720.

ORNAMENTAL CRYSTAL ELECTROLIER.

Length, 78 in. Spread, 44 in.

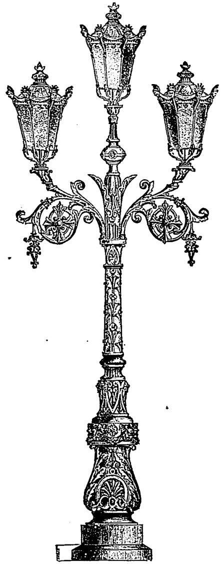
Polished Brass, 14 Lights, Upper Tier 7 Lights, Lower Tier 7 Lights, ... Price $450 00
Gold Bronze, 14 " " 7 " " 7 " . . . . " 475 00

Glass Flowers or Holders not included in above prices.



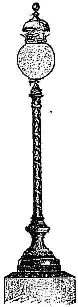
No. 815.—"Renaissance."

Height to bottom of Lamp, 6 ft. 3 in.
Diameter of Base, 2 ft. 3 in.



No. 820.—"Renaissance."

Height to bottom of Centre Lamp, 15 ft.
Diameter of Base, 2 ft 1 in.
Furnished also for Four or Five Lamps.



No. 825.—For Newells.

Height to bottom of Globe, 5 ft.
Base, 1 ft. 2 in.

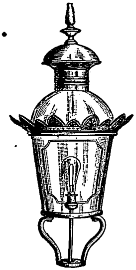
LAMP PILLARS.

No. 815, Bronzed, for Centre Lantern only,	Price	$49 50
No. 820, " " and 2 Arms,	"	236 50
No. 820, " " 3 "	"	264 00
No. 820, " " 4 "	"	291 50
No. 825, " " only,	"	15 00

These prices do not include Sockets, Lanterns or Globes.

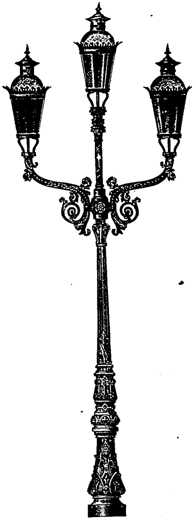
No. 815,	Bronzed,	for Centre Lantern only,	Price	$49 50
No. 820,	"	" and 2 Arms,	"	236 50
No. 820,	"	" 3 "	"	264 00
No. 820,	"	" 4 "	"	291 50
No. 825,	"	" only,	"	15 00

These prices do not include Sockets, Lanterns or Globes.



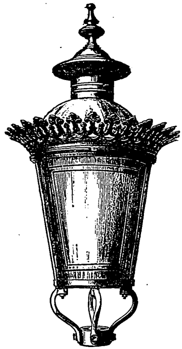
No. 830—Height, 30 in.

STREET LANTERN.



No. 840—"Renaissance."

LAMP PILLAR.



No. 835—Height, 36 in. No. 836—Height, 42 in.

STREET LANTERN.

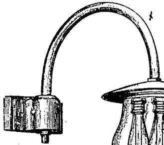
Height to bottom of Centre Lamp, 10 ft. 6 in.
Diameter of Base, 1 ft. 2 in. Furnished also for Five Lamps.

No. 830,	Street Lantern, Painted or Bronzed, without Sockets,	Price	$12 00
No. 835,	" " " "	"	15 00
No. 836,	" " " "	"	45 00

The Glass in these Lanterns is in three parts, viz.: two Half-Cylinders and a Dome. Prices for above sizes as follows:

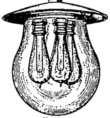
	Half-Cylinder.	Dome.
No. 830, each,	$1 60	$1 50
No. 835, "	2 00	2 00
No. 836, "	5 00	1 25 per quarter.

No. 840, Lamp Pillar, for Three Lanterns, Bronzed, not including Sockets or Lanterns, ... $62 00



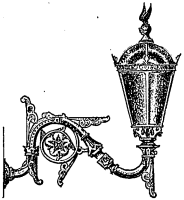
No. 905.

LAMP BRACKET,
With Switch.
Length, 18 in.



No. 906.

STREET LANTERN.
Spread, 10 in.



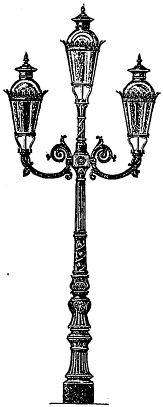
No. 910.

LAMP BRACKET.
Length, 2 ft. 11 in.

No. 905, Lamp Bracket, Bronzed or Painted,	$4 50
No. 910, " " "	16 00
No. 915, " " "	11 00

These prices do not include Sockets or Lanterns.

No. 906, Lantern, including three No-key Sockets and Globe,	$4 50
Globe only,	75



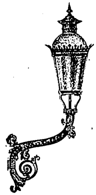
No. 845. "Renaissance."

LAMP PILLAR.

Height to bottom of Centre Lamp, 9 ft. 5 in., Base, 10½ in. square.

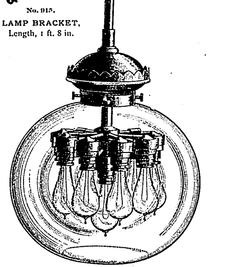
No. 845, Lamp Pillar, for 3 Lanterns, Bronzed,	$50 00
No. 845, " 5 " "	72 00

Not including Sockets or Lanterns.



No. 915.

LAMP BRACKET,
Length, 1 ft. 8 in.

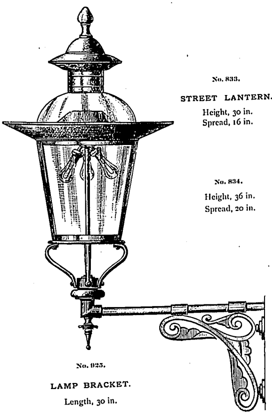


No. 900.

CLUSTER GLOBE FOR DISPLAY.

	Bronzed.	Pol'd Brass.
14 in. Globe, with 5-Light Cluster,	$17 50	$22 50
16 " " 7 "	21 00	28 00
16 " " 9 "	23 00	31 00

Including No-Key Sockets.



No. 833.

STREET LANTERN.

Height, 30 in.
Spread, 16 in.

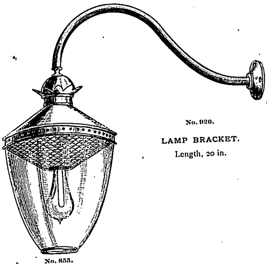
No. 834.

Height, 36 in.
Spread, 20 in.

No. 925.

LAMP BRACKET.

Length, 30 in.



No. 855.

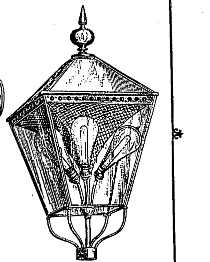
STREET LANTERN.

Height, 20 in. Spread, 12 in.

No. 920.

LAMP BRACKET.

Length, 20 in.



No. 860.

STREET LANTERN.

Height, 26 in

No. 833, Street Lantern, without Socket, Painted or Bronzed,	Price	$10 00
834, " " " " "	"	12 00
855, " " " " "	"	9 00
860, " " " " "	"	20 00

These prices do not include the inside Reflectors shown in cuts.

No. 920, Lamp Bracket, Bronzed or Painted,	Price	$1 50
925, " " "	"	7 50

Any Length to Order.

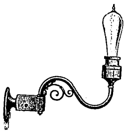
Prices of Reflectors vary according to styles, whether Corrugated Metal or Silver Corrugated Glass.

LAY.
Pol'd Brass.
$22 50
28 00
31 00

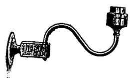
SWINGING BRACKETS.

Patented Sept. 24, 1878.

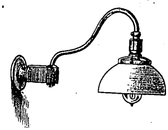
These brackets are provided with a patented insulating contact device by which the continuity of the circuit is maintained without carrying the wires through the joints, thus permitting the bracket to be moved into any desired position.



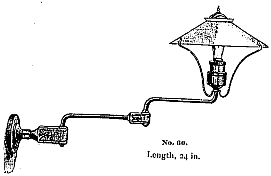
No. 55.
Length, 12 in.



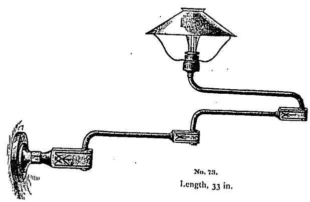
No. 50.
Length, 12 in.



No. 51.
Length, 12 in.



No. 60.
Length, 24 in.



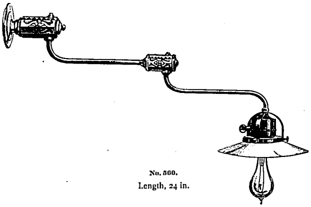
No. 73.
Length, 33 in.

		Bronzed.	Polished Brass.	Gold Bronze.
No. 50, including Key Sockets,	Price	$3 50	$4 50	$4 75
No. 51, " "	"	3 50	4 50	4 75
No. 55, " "	"	3 75	4 80	5 10
No. 60, " "	"	5 40	6 90	7 20
No. 73, " "	"	7 00	8 75	9 25

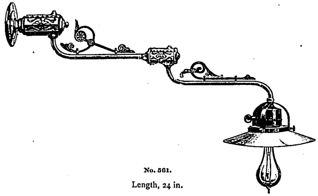
Shades or Holders not included in above prices.

SWINGING BRACKETS.

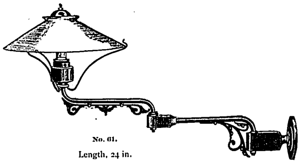
Patented Sept. 24, 1878.



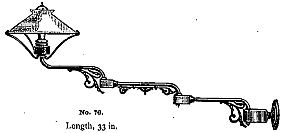
No. 560.
Length, 24 in.



No. 561.
Length, 24 in.



No. 61.
Length, 24 in.



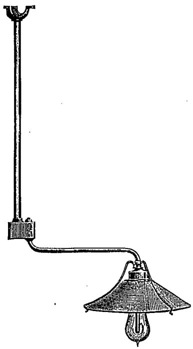
No. 76.
Length, 33 in.

		Bronzed.	Polished Brass.	Gold Bronze.
No. 560, including Key Sockets,	Price	$5 40	$6 90	$7 20
No. 561, " "	"	6 50	8 00	8 35
No. 61, " "	"	6 50	8 00	8 35
No. 76, " "	"	8 50	10 25	10 75

Shades or Holders not included in above prices.

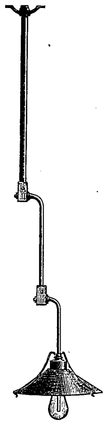
SWINGING BRACKET FIXTURES.

Patented Sept. 24, 1878.



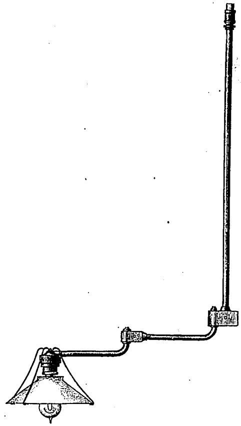
No. 78.

Length of Bracket, 12 in.



No. 400.

Length of Bracket, 22 in.



No. 67.

Length of Bracket, 22 in.

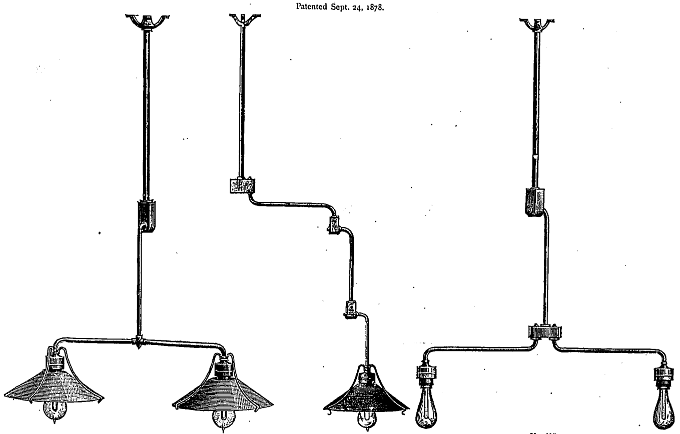
		Bronzed.	Polished Brass.	Gold Bronze.
No. 78, including Key Sockets,	Price	$3 50	$4 50	$4 75
No. 400, " "	"	5 25	6 75	7 00
No. 67, " "	"	5 40	6 90	7 20

These prices do not include Upright Stems, Shades or Holders.

Gold Bronze.
$4 75
7 00
7 20

SWINGING BRACKET FIXTURES.

Patented Sept. 24, 1878.



No. 410.

Bracket, 15 in. long. Spread, 24 in.

No. 405.

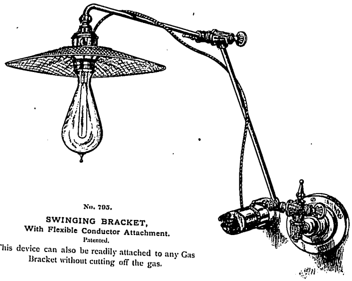
Bracket, 15 x 24 in.

No. 415.

Bracket, 15 in. long. Spread, 24 in.

		Bronzed.	Pol'd Brass.	Gold Bronze.
No. 410, including Key Sockets,	Price	$5 50	$6 75	$7 10
No. 405, " "	"	7 75	10 25	10 75
No. 415, " "	"	8 50	11 00	11 50

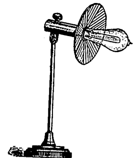
These prices do not include Upright Stems, Shades or Holders.



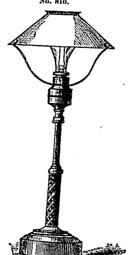
No. 795.

SWINGING BRACKET,
With Flexible Conductor Attachment.
Patented.

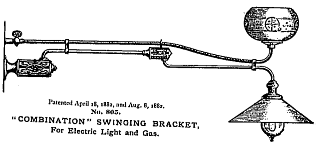
This device can also be readily attached to any Gas Bracket without cutting off the gas.



No. 810.



No. 124.



Patented April 18, 1882, and Aug. 8, 1882.
No. 805.

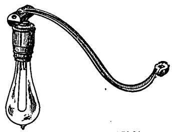
"COMBINATION" SWINGING BRACKET,
For Electric Light and Gas.

		Bronzed.	Pol'd Brass.	Gold Bronze.
No. 795, including Flexible Conductor, Attaching Plug and Receptacle,	Single Swing,	$3 00	$4 00	$4 20
	Double "	4 00	5 00	5 25
	Triple "	5 00	6 00	6 35
No. 805, Single Swing,		5 25	7 00	7 25
Double "		7 50	9 00	9 35
Triple "		9 75	12 00	12 50
Including Key Sockets.				

	Bronzed.	Pol'd Brass.	Gold Bronze.
No. 810, Reflecting Lamp Stand, with Swivel joint and 8-in. Silvered Glass Reflector, including Key Socket,	$5 00	$5 75	$6 00
No. 810, with Tin Reflector,	4 25	5 00	5 25
No. 124, Portable Desk Lamp, including Key Socket,	3 75	4 25	4 50

Globes, Shades or Holders not included in above prices.

ass.	Gold Bronze.	
75	$6 00	
.00	5 25	
25	4 50	



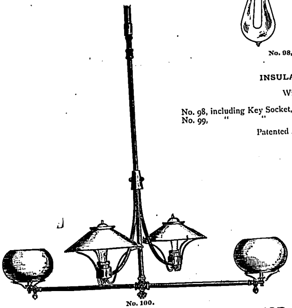
No. 98, 1 Light; No. 99, 2 Lights.

INSULATING ATTACHMENT

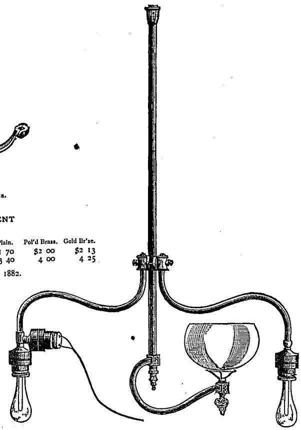
Will fit any gas burner.

		Plain.	Pol'd Brass.	Gold Br'ze.
No. 98, including Key Socket,	Price	$1 70	$2 00	$2 13
No. 99, " "	"	3 40	4 00	4 25

Patented April 18 and August 8, 1882.



No. 100.



No. 101.

INSULATING ATTACHMENTS FOR GAS CHANDELIERS IN TWO OR MORE LIGHTS.

Patented April 18 and August 8, 1882.

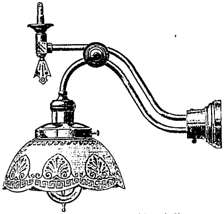
		2 Lights.	4 Lights.
Bronzed, Spread 24 in., including Key Sockets,	Price	$4 50	$8 50
Polished Brass, " " "	"	5 50	10 50
Gold Bronze, " " "	"	6 00	11 00

In ordering No. 100 or 101, state size of Chandelier Stem where attachment is fastened.

		2 Lights.	4 Lights.
Bronzed, Spread 24 in., including Key Sockets,	Price	$4 50	$8 50
Polished Brass, " " "	"	5 50	10 50
Gold Bronze, " " "	"	6 00	11 00

Extra for Receptacle Attachment, as shown in cut, Price $1 00

Shades or Holders not included in above prices.

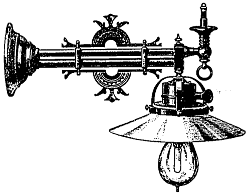


No. 1050. Patented April 18 and August 8, 1882.

PLAIN COMBINATION LIGHT BRACKET.

Bronzed, Length 12 in., including Key Socket,	Price	$4 50
Polished Brass, " " "	"	5 75
Gold Bronze, " " "	"	6 00

Globes or Holders not included in above prices.

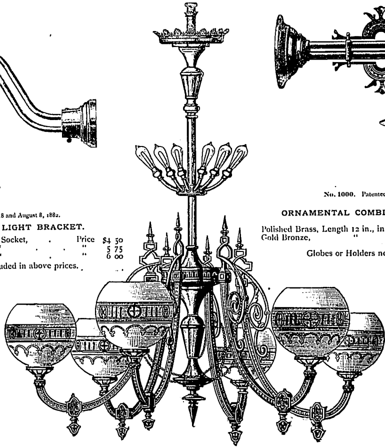


No. 1000. Patented April 18 and August 8, 1882.

ORNAMENTAL COMBINATION LIGHT BRACKET.

Polished Brass, Length 12 in., including Key Socket,	Price	$7 00
Gold Bronze, " " "	"	7 25

Globes or Holders not included in above prices.

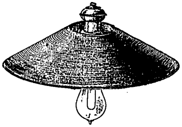


No. 775. Patented April 18 and August 8, 1882.

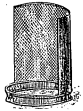
SHOWING CLUSTER OR CORONA OF LIGHTS. ATTACHMENTS ON GAS CHANDELIER.

Made in halves, which can be readily attached to any Chandelier. In ordering state size of gas pipe and covering tube in gas fixture. Lights can be turned down or up.

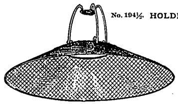
		Bronzed.	Pol'd Brass.	Gold Br'ze.
2 Lights, including No-Key Sockets,	Price	$5 00	$6 00	$6 25
4 " " "	"	6 75	8 00	8 35
6 " " "	"	8 50	10 00	10 50
8 Lights, including No-Key Sockets,	Price	$10 25	$12 00	$12 75
12 " " "	"	12 00	14 00	15 00



No. 193.



No. 196.

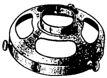


No. 194½. HOLDER.

No. 194.

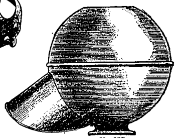
PATENTED CORRUGATED METAL REFLECTING SHADES.

Nickel Plated.

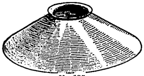


No. 201. 3¼ in.
No. 202. 2¼ in.
HOLDER.
Patented.

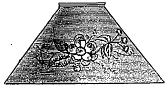
No. 200. 3¼ in.
HOLDER.



No. 197.
PULPIT HOOD.



No. 195.
PLAIN PORCELAIN SHADE.



No. 198.
DECORATED PORCELAIN SHADE.

REFLECTORS.

No. 194,	Corrugated Metal Reflector, Nickel Plated, 10 in.,	$0 23
No. 194½,	Wire Holder, shown on same, ⅛, ¼, or ⅜,	10
No. 193,	Corrugated Metal Reflector, Nickel Plated, 10 in., can be attached to socket without separate holder,	28
No. 196,	Screen Reflector, 6 in. high, will fit 3¼ in. holder,	22
No. 197,	Pulpit Hood, with inside Reflector,	3 00

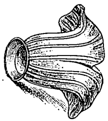
	Pol'd Brass.	Gold Bronze.
No. 200, Holder, 3¼ in.,	$0 30	$0 32
No. 201, " 3¼ in., with Rubber Screw Ring,	22	25
No. 202, " 2¼ in.,	20	22
10-in. Plain Wire Holder,	12	14
10-in. Portable Shade Holder,	25	28

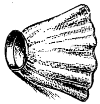
PORCELAIN SHADES.

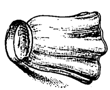
	Price per Doz.
No. 195, Porcelain Shade, 10 in. flat,	$4 00
" " 10 in. high (shape of No. 198),	4 25
" " 8 in. flat,	3 75
" " 8 in. high,	4 00
No. 198, Decorated Porcelain Shades, in great variety of styles and prices, among which are	
A, Decorated on White Ground,	10 00
B, " " "	11 00
C, " " "	13 50
D, " Tinted "	20 00
E, " " "	34 00
F, " " "	40 00

	Price per lb.
Patent Clinch Staples, ¾,	$0 30
" " " 1,	27
" " " 1¼,	27
" " " 1½,	27

COLORED GLASS FLOWERS.


No. 1200.


No. 1205.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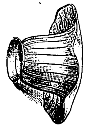
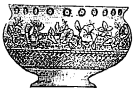
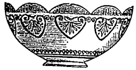
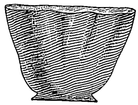
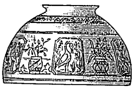

No. 1215.


1250 A.

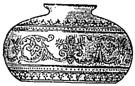

1255 A.

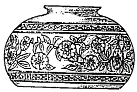

1260 A.


No. 1240.


1275 A.


1275 B.


1285 A.


1285 B.

ETCHED GLOBES.

For Prices See Opposite Page.

GLASS FLOWERS.

Number.	Style.	Size of Holder, 2¼ in.		Size.	Price per Doz.
No. 1200	A	White Pink, . .	Glass Flowers	4 in. long. 6 in. spread.	$21 50
	B	White Yellow, . . .	"		18 50
	C	Pale Green, . . .	"		16 50
No. 1205	A	Ruby, ...	"	3½ in. long. 5 in. spread.	19 00
	B	Opalescent, . . .	"		16 50
	C	Pearl, ...	"		16 50
	D	Ruby, ...	"	5 in. long. 6 in. spread.	20 50
	E	Opalescent, . . .	"		18 00
	F	Pearl, ...	"		18 00
No. 1210	A	Ruby, ...	"	4 in. long. 4 in. spread.	16 50
	B	Opalescent, . . .	"		15 50
	C	Pearl, ...	"		15 50
No. 1215	A	Ruby, ...	"	4½ in. long. 6 in. spread.	20 50
	B	Opalescent, . . .	"		18 00
	C	Pearl, ...	"		18 00
No. 1220 Shown in cuts, page 74.	A	Ruby, ...	"	3 in. long. 6 in. spread.	19 50
	B	Corrugated Dark Amber,	"		19 50
	C	Clear Amber, . . .	"		16 50
	D	Opalescent, . . .	"		16 50
	E	Pearl, ...	"		16 50
No. 1225 Shown in cut No. 345, p. 46.	A	Ruby, ...	"	4 in. long. 3 in. spread.	19 00
	B	Clear Amber, . . .	"		16 50
	C	Opalescent, . . .	"		16 50
	D	Pearl, ...	"		16 50
No. 1240	A	Ruby, ...	"	7 in. spread. 3¼ holder.	28 50
	B	Amber, ...	"		26 50
	C	Opalescent, . . .	"		25 00
	D	Pearl, ...	"		25 00
	E	Yellow, ...	"		27 50

ETCHED GLOBES.

Number.	Size of Holder, 3¼ in.	Size.	Price per Doz.
No. 1285	"Squat" Etched Globes, ... (Styles, A B C, etc., etc.)	7½ in.	$10 50
No. 1275	"Pan" Etched Globes, ... (Styles, A B C, etc., etc.)	7 in.	12 25
		7½ in.	12 50
		8 in.	13 00
No. 1260	"Scolloped Pan" Etched Globes, . . (Styles, A B C, etc., etc.)	7 in.	14 50
		7½ in.	15 00
		8 in.	16 00
No. 1250	"Crown" Etched Globes, . . . (Styles, A B C, etc, etc.)	7 in.	16 00
		7½ in.	16 50
No. 1255	"Cut Crown" Etched Globes, . . . (Styles, A B C, etc., etc.)	7 in.	17 50
		7½ in.	18 00

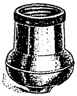
OPAL GLOBES.

No. 1150	Pan Opal Globes, Plain White, . .	7 in.	3 75
		7½ in.	4 00
		8 in.	4 50
No. 1160	Squat Opal Globes, Plain White, . .	7½ in.	4 00
No. 1170	Decorated Opal Globes, in great variety of styles and prices, among which are—		
	A, Decorated on White Ground, . .	7½ in.	15 00
	B, " Tinted " . . .	7½ in.	18 50
	C, " " " . . .	7½ in.	32 00
	D, " " " . . .	7½ in.	42 00

In ordering Etched or Decorated Globes, state whether to be used with up or down lights.

STANDARD EDISON LAMP SOCKETS AND SWITCHES.

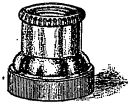
Patented.



No. 1.

STANDARD NO-KEY SOCKET.

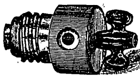
Patented Dec. 27, 1881, and May 2, 1882.
Canadian Patent, Jan. 10, 1883.



No. 3.

STANDARD RECEPTACLE.

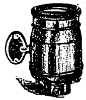
Patented Dec. 27, 1881, and May 2, 1882.
Canadian Patent, Jan. 10, 1883.



No. 4.

STANDARD ATTACHING PLUG.

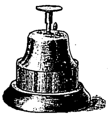
Patented.



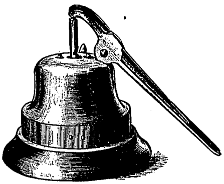
No. 2.

STANDARD KEY SOCKET.

Patented Dec. 27, 1881, and May 2, 1882.
Canadian Patent, Jan. 10, 1883.

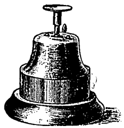


No. 212.



No. 216.

No. 210.



No. 215.

STANDARD SWITCHES.

Patented May 2, 1882, in the United States and Canada.

		Plain.	Pol'd Brass.	Gold Br'ze.
No. 1, Standard No-Key Socket,	Price	$0 40	$0 46	$0 48
No. 2, " Key Socket,	"	82	90	92
No. 3, " Receptacle,	"	40	44	46
No. 4, " Attaching Plug,	"			40

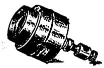
Standard Polished Brass or Gold Bronze Sockets are ⅛ thread. Standard Plain Sockets are ⅛, ¼, or ⅛, as desired.

			Plain.	Pol'd Brass.	Gold Br'ze.	Nic. Pla.
No. 210, Standard Switches,	1 to 6 Lights,	Price	$2 35	$2 50	$2 60	$3 00
No. 212, "	to 25 "	"	3 65	3 85	4 00	4 50
No. 215, "	to 50 "	"	5 35	5 60	5 80	6 60
No. 216, "	to 100 "	"	7 35	7 65	7 90	9 00
No. 217, "	to 250 "	"	11 50	12 00	12 30	14 00

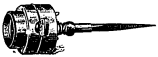
PORTABLE SOCKETS.

Patented.

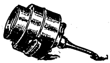
These Sockets are provided with devices by means of which they can be readily attached to any place where light may be temporarily required, the current being brought to them through flexible conducting cord.



No. 100.



No. 155.



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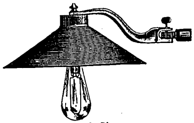

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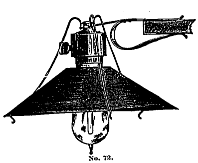
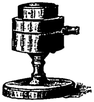


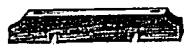
No. 72.

No. 70.



No. 135.

No. 190.



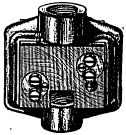
No. 189.

				With Key.	Without Key.
No. 155, Spike Socket,	Without Cord,	Polished Brass,	Price	$1 50	$1 06
"	"	Gold Bronze,	"	1 55	1 11
No. 160, Sliding Socket,	"	Polished Brass,	"	1 35	91
"	"	Gold Bronze,	"	1 40	96
No. 165, Hook Socket,	"	Polished Brass,	"	1 20	76
"	"	Gold Bronze,	"	1 25	81
No. 72, Spring Clamp Socket,	"	Polished Brass,	"	2 25	1 81
"	"	Gold Bronze,	"	2 35	1 91
"	"	Nickel Plated,	"	2 50	2 06
No. 70, Screw Clamp Socket,	"	Bronzed,	"	1 50	1 06
No. 74, "	"	"	"	1 50	1 06
No. 135, Stand Socket,	"	"	"	1 50	1 06
"	"	Polished Brass,	"	2 50	2 06
"	"	Gold Bronze,	"	2 65	2 21

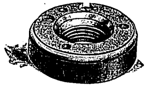
No. 189, Wood Cleats for large wires,	Price per Hundred	$0 90
" small "	" "	90
No. 190, Iron Socket Flange, 1/8, 1/4, or 3/8, plain,	Price	$0 04
No. 191, Bracket Flange, 1/8, 1/4, or 3/8,	"	10
Nozzles, 1/4 x 1/8, each,	Price	$0 10
" 3/8 x 1/8, "	"	13
" 1/2 x 1/8, "	"	18
Electrolier Hooks, 1/4, each,	Price	$0 20
" 3/8, "	"	25
" 1/2, "	"	30

PATENTED DEVICES FOR WIRING AND PUTTING UP ELECTROLIERS, BRACKETS, ETC.

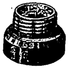
These Devices are manufactured and sold under patents which are controlled exclusively by us, and the public are respectfully warned against all infringements of these or any of our Patented Devices. Our Devices are the only ones which comply with the requirements of the Board of Fire Underwriters and the rules and regulations laid down by the Engineering Department of the Edison Electric Light Company.



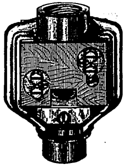
No. 1100.
Patented June 6 and Oct. 24, 1882.



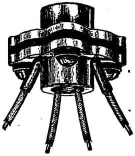
No. 187.
Patented August 22, 1882.



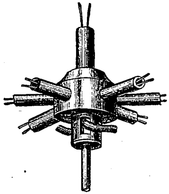
No. 188.
Patented August 22, 1882.



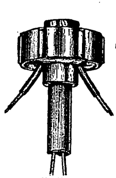
No. 1105.
Patented June 6 and Oct. 24, 1882.



No. 1110.
Patented June 6 and Oct. 24, 1882.



No. 1125.
Patented June 6 and Oct. 24, 1882.



No. 1115.
Patented June 6 and Oct. 24, 1882.

No. 79.

These Devices are sold with our own fixtures, irrespective of the number of lights, at the prices in first column.

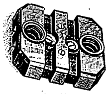
		For 1 or 2 Light Fixture.	For 3 Light Fixture.	For 4 Light Fixture.	For Additional Lights, Per Light.
No. 1105, Insulating Open Yoke with Cut-out, sizes 3/8x1/4, 3/8x3/8, 1/2x3/8, 1/2x1/2.	Price	$2 00	$2 65	$3 30	$0 65
No. 1100, Non-insulating " " " " " "	"	1 50	2 15	2 80	65
Also furnished to fasten to ceiling with screws or bolts instead of to pipe outlet—same price.					
No. 1110, Insulating Bracket Union, sizes 3/8x1/4, 3/8x3/8, 1/2x3/8, 1/2x1/2.	"	1 35	2 00	2 65	65
No. 1115, " Electrolier " " " " " "	"	1 35	2 00	2 65	65
No. 1125, Open Body for Wiring existing gas fixtures, sizes 1/4x1/4, 3/8x1/4, 1/2x1/2.	"	50	1 00	1 50	50

No. 187, Electrolier Ceiling Connecting Block, Price $1 25—No. 188, Plug for same, Price $1 00
No. 79, Open Ceiling Flange, sizes 1/4, 3/8, or 1/2 in., Price: Plain, 8c.; Bronzed, 12c.; Polished Brass, 35c.

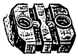
Special Discount to Manufacturers.

STANDARD SAFETY CUT-OUTS AND PLUGS.

Patented May 2, 1882, and Sept. 12, 1882. Canadian Patent January 23, 1883.



No. 930.



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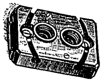
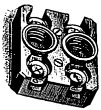


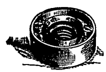
No. 940.

No. 945.

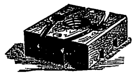


No. 960.

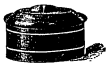
No 965.



No. 184.

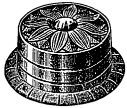


No. 186. For Moulding Work.
No. 186½. For Cleat Work.



No. 175.

No. 181. Size No. 1.
No. 182. Size No. 2.



No. 176.

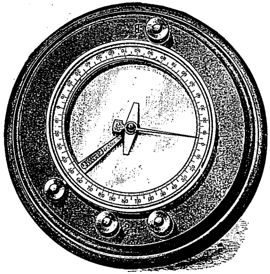
No. 975.

No. 184, Single Pole	Main Line Cut-out,	No. 1,	1 to 30 Lights,			$0 32
No. 186, "	Branch "	"	to 30 "	for Moulding Work,		36
No. 186½, "	" "	"	to 30 "	Cleat	"	36
No. 965, D'ble Pole	Main Line "	"	to 30 "	Moulding	"	43
No. 935, "	Branch "	"	to 30 "	"	"	48
No. 945, "	" "	"	to 30 "	Cleat	"	48
No. 960, "	Main Line "	No. 3,	to 100 "	Moulding	"	1 10
No. 930, "	Branch "	"	to 100 "	"	"	1 20
No. 940, "	" "	"	to 100 "	Cleat	"	1 20

No. 181, Capped Safety Plug for No. 1 Cut-outs,	1 to 30 Lights,		$0 08
No. 182, " " " No. 3 "	1 to 100 "		16
No. 975, Double Pole House Cut-out Box,	1 to 150 "	including Plugs,	6 00
Separate Plugs for same, each			85

	Plain Bronzed.	Pol'd Brass.	Gold Bronze.	Nickel Plated.
No. 175, Plain Cap for No. 184 Cut-out,	$0 10	$0 16	$0 18	$0 25
No. 176, Fancy " " "	32	70	76	1 00

APPARATUS FOR ELECTRIC LIGHT ENGINEERS.



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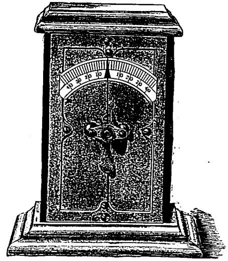

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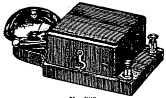
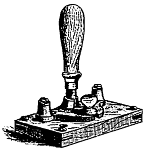
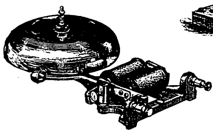


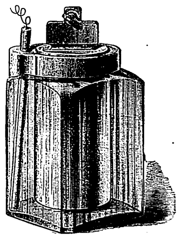
No. 980.



No. 990.



No. 985.



No. 300.

	High Resistance.	Low Resistance.
No. 265, Horizontal Detecting Galvanometers,	$18 00	$15 00
No. 260, Vertical " "	42 50	35 00

In ordering Galvanometers state resistance desired.

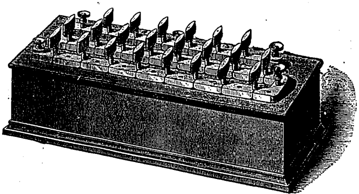
	Pol'd Brass.	Nickel Plated.
No. 980, 3 in. Box Bell, ...	$2 75	$3 00
No. 985, 4 in. Skeleton Bell, ...	4 75	5 30
6 in. "	6 00	6 65
8 in. "	11 75	12 50

	Diameter of Plug ½ in.	¾ in.	1 in.
No. 990, Plug Switch, mounted on hard wood base, . .	$1 50	$2 50	$3 50

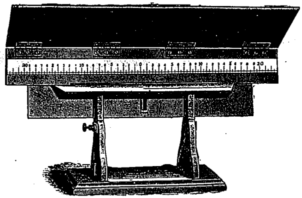
No. 300, Leclanché Battery for Testing, . . .	$1 60
No. 301, Standard Batteries for Measuring, . . .	1 30

Adopted by the Edison Electric Light Companies.

APPARATUS FOR ELECTRIC LIGHT ENGINEERS.



No. 256.



No. 257.

No. 995.

No. 256, Improved Wheatstone Bridge, . Price $180 00
Total Resistance 10,000 ohms.

Distributed as follows:
1, 2, 2, 5, 10, 10, 20, 50, 100, 100,
200, 500, 1000, 1000, 2000, 5000.

Branch Resistances,
1000, 100, 10,—10, 100, 1000.

Also, with 5000 ohms Resistance, Price $120 00
1, 2, 2, 5, 10, 10, 20, 50, 100, 100,
200, 500, 1000, 1000, 2000.

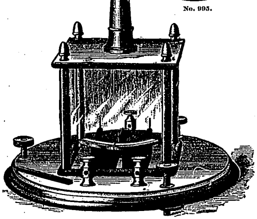
Branch Resistances,
100, 10,—10, 100.

No. 257, Reflecting Galvanometer Scale, . Price $10 50

No. 255, Square Astatic Galvanometer,
High Resistance, ... Price . $30 00
Low " . . . . " 25 00

No. 1025, Round Astatic Galvanometer,
High Resistance, ... Price $57 50
Low " . . . . " 32 50

No. 995, Horizontal Detecting Galvanometer,
with Key, ... Price $6 00



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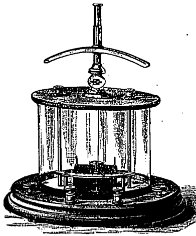
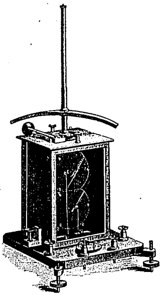


No. 1025.

APPARATUS FOR ELECTRIC LIGHT ENGINEERS.



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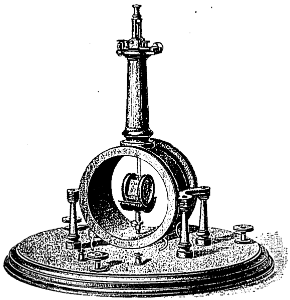
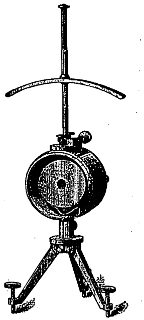


No. 253.

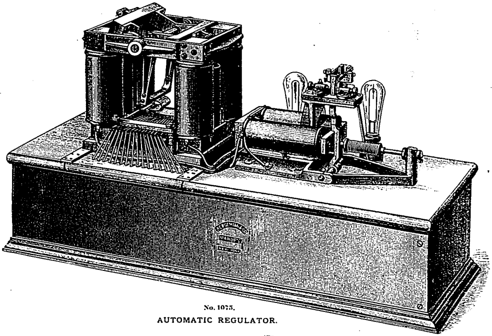


No. 250.

		Low Resistance.	High Resistance.
No. 250, Single Coil Thompson Reflecting Galvanometer,	Price	$90 00	$120 00
No. 252, Double " " " "	"	115 00	140 00

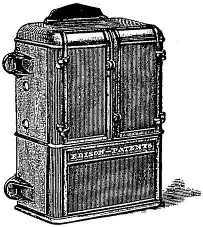
No. 253, Electric Dynamometer, ... Price $140 00

APPARATUS FOR ELECTRIC LIGHT ENGINEERS.



No. 1075.

AUTOMATIC REGULATOR.



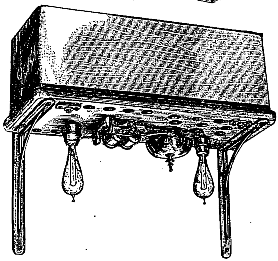
No. 1350.

EDISON'S SYSTEM METER.

Prices, with Bottles, Zinc Plates and Rubber Fixtures,

complete, 25 Light Meter,	$11 50
50 "	15 50
100 "	23 50

No. 259, Standard Pressure Indicator,	$64 50



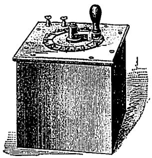
No. 259.

STANDARD PRESSURE INDICATOR.

No. 1075, Automatic Regulator, including Resistance Box, and Glass Cover,

For One	Z	Dynamo,	Price	$200 00
Two	Z	"	"	210 00
One	L	"	"	210 00
Two	L	"	"	230 00
One	K	"	"	220 00
Two	K	"	"	250 00
Three	K	"	"	280 00

APPARATUS FOR ELECTRIC LIGHT ENGINEERS.



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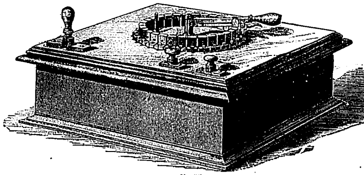

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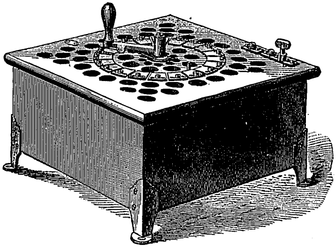
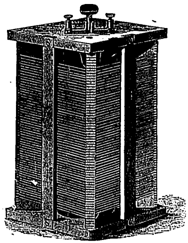


No. 281.



No. 275.

RESISTANCE BOXES AND HAND REGULATORS.

		1 E.	1 Z.	2 Z.	1 L.	2 L.	1 K.	2 K.	3 K.
Nos. 276 and 281,	Price	$18 00	$25 00	$28 00	$36 00	$46 00	$38 00	$48 50	$64 00
No. 280, Fancy,	"	25 00	35 00	38 00	55 00	70 00	57 00	72 50	90 00

No. 275, Open Spool Resistance, to order of any desired resistance, 1 to 3 ohms, ... Price $3 75

In ordering Regulators state whether for A or B Lamps.

INDEX TO FIXTURES, ETC.

This Index refers ONLY to Fixtures and Appliances manufactured by Messrs. Bergmann & Co.

ELECTROLIERS, PENDANTS, Etc.

HALL LIGHTS.

NEWELLS AND STANDARDS.

REFLECTORS, SUNLIGHTS, REFLECTING SHADES, HEADLIGHTS, Etc.

"COMBINATION LIGHT" FIXTURES, ATTACHMENTS FOR GAS FIXTURES, Etc.

STATIONARY BRACKETS, SCONCES, Etc.

EDISON COMPANY FOR ISOLATED LIGHTING,

65 FIFTH AVENUE, NEW YORK CITY.

EDISON LAMP COMPANY,

EAST NEWARK, NEW JERSEY.

EDISON MACHINE WORKS.

104 GOERCK STREET, NEW YORK CITY.

EDISON TUBE COMPANY,

65 WASHINGTON STREET, NEW YORK CITY.

MESSRS. BERGMANN & CO.,

MANUFACTURERS OF FIXTURES, &C., FOR THE EDISON LIGHT,

292 TO 298 AVENUE B, NEW YORK CITY.

EDISON COMPANY FOR ISOLATED LIGHTING.

REPORT

OF THE

BOARD OF TRUSTEES

TO THE

STOCKHOLDERS

AT THEIR

ANNUAL MEETING,

NOVEMBER 18TH,

1884.

NEW YORK:
C. G. BURGOYNE'S "QUICK" PRINT, 146-150 CENTRE STREET,
1884.

BOARD OF TRUSTEES

ELECTED NOVEMBER 20, 1883.

THOMAS A. EDISON, CHAS. H. COSTER,
S. B. EATON, SPENCER TRASK,
E. H. JOHNSON, J. C. HENDERSON,
ANTHONY J. THOMAS.

EXECUTIVE COMMITTEE.

S. B. EATON, CHAS. H. COSTER,
E. H. JOHNSON.

OFFICERS.

S. B. EATON, *President.**
F. S. HASTINGS, *Treasurer.*
J. HUTCHINSON, *Secretary.*

GENERAL OFFICES:

65 Fifth Avenue, New York City.

* Resigned, and E. H. Johnson elected President, October 14th, 1884.

BOARD OF TRUSTEES

ELECTED NOVEMBER 18, 1884.

T. A. EDISON, F. R. UPTON,
E. H. JOHNSON, A. J. THOMAS,
SPENCER TRASK, J. HOOD WRIGHT,
CHARLES BATCHELOR, THOMAS C. BUCK.
C. H. COSTER, F. S. SMITHERS,
EUGENE CROWELL.

EXECUTIVE COMMITTEE.

E. H. JOHNSON, C. H. COSTER,
F. R. UPTON, F. S. SMITHERS.

OFFICERS.

E. H. JOHNSON, *President and General Manager.*
J. HUTCHINSON, *Manager.*
F. S. HASTINGS, *Secretary and Treasurer.*

GENERAL OFFICES:

65 Fifth Avenue, New York City.

To the Stockholders of

The Edison Co. for Isolated Lighting:

During the year ending November 1st, 1884, 143 isolated plants, aggregating 19,390 lights, have been installed, making a total, since the formation of your company, of 417 plants for 75,145 lights. These installations have been of almost every kind, as was explained in the last annual report, but during the present year the general depression of all manufacturing interests has seriously interfered with sales to factories, heretofore an important feature in your business.

In addition to permanent installations a profitable business has been done during the past year in renting plants to theatres, exhibitions, halls, &c.

The profits from lamp renewals have also been large, and they promise to increase from year to year.

Over two years ago a separate department was formed for conducting your business in New England. This department proved a source of heavy expense, exceeding $18,000 in a year and one quarter, without producing adequate returns, but subjecting your company to very serious losses from bad debts and other causes. As your Board could not see any reason whatever for its continuance, it was formally disbanded on July 1st, 1884, and the New England business is now conducted with profit through your New York office.

During the present year your Company has been put to heavy expense for the purpose of taking part in several large electrical exhibitions, especially in one recently held at Philadelphia. Your Directors felt bound to see that the Edison light was properly represented, but they now believe that the system is so well known, and its merits so generally recognized, that you can afford to hold

aloof from many of these exhibitions, which, in themselves, do not produce any corresponding benefit. You can refer to the Edison light, whether isolated, underground station or village plant, in actual operation, and your absence from these expensive exhibitions can not any longer be misunderstood.

A source of constant trouble in the financial management of your Company during the past year has been the heavy cash outlay incurred while each installation is in progress, and even after its completion, as payment is not made therefor until some time afterwards. The length of time which thus elapses is far greater than the credit which your Company is allowed by the manufacturers of the machinery, &c., and for the *labor* of installing (a heavy item), cash must, of course, be paid. Furthermore, your Company is obliged to carry a large stock of unemployed goods, to have them on hand for installations as required. Consequently, it may be said that the larger the business done by your Company, the more difficult it becomes to make receipts take care of payments. Steps are in progress which, if successful, will correct this in part, but it is clear that your present paid-in capital is too small for your business, and it will be for your next Board to decide whether it may not be wiser to put the Company in easier circumstances by making a further call for some part of your unpaid stock.

In the spring of 1884 negotiations were commenced between your Board and that of the Edison Electric Light Company, looking to the transfer to you of the business of exploiting and installing central station and village plants *within* the limits of gas territory. Such business *outside* of those limits already belonged to you under your original contract with the parent Company. On the first day of September last, a contract was executed between the two companies (after ratification by their respective shareholders), by which you undertook such exploiting and installing within gas limits, on a basis of an equitable division of profits; but as it was recognized that this new business would subject you to additional expense and *might*, possibly, not produce any adequate returns, the Light Co. agreed to make the dividends on the stock of your company held by it, secondary to the payment of dividends on your remaining

stock, as is best explained by the following extract from the contract, as executed:

ELEVENTH. Whereas the Light Co. now owns fifty-one one-hundredths of the capital stock of the Isolated Co., and, under its said contract with the Isolated Co., dated April 26th, 1882, is entitled to receive, without additional compensation, a like proportion of all future increases of said capital, which provision of the said agreement, it is agreed, this contract does not in any way alter or disturb; and, whereas, the Light Co. consents, during the continuance of this agreement, and as further and special compensation to the Isolated Co., to make certain concessions touching dividends on its said stock, in favor of the other stockholders, to wit, the holders of the remaining forty-nine one-hundredths (which stock, for convenience of designation, is herein called *cash stock*, as distinguished from the Light Co's. holdings, herein called *Light Co. stock*): it is agreed as follows, that is to say:

1. All net earnings of the Isolated Co., applicable to dividends, shall, during the continuance of this agreement, be applied, first, to paying a dividend of, or dividends aggregating not more than, eight per centum per annum on the said cash stock; second, to paying a like dividend, or like dividends, on the Light Co's. stock, aggregating not more than eight per centum per annum; and, third, after the said dividends aggregating eight per centum per annum on both classes of stock shall have been paid, any surplus shall be distributed among all the stockholders according to holdings, including both the cash stock and the Light Co's. stock.

2. As to the said dividends, each year shall stand by itself, and no deficiency in any one year, whether as to dividends on the cash stock or on the Light Co's. stock, shall be carried over to another year.

During the past year your company has met with active competition from numerous infringers on the Edison patents, who, encouraged by the inaction by the Light Co., have become more and more emboldened, until many of them now exist as organized companies, working in opposition to your own. Your Board is happy to say that the Light Co. is now taking active steps to protect its patents in the courts, and there seems to be every reason to hope that speedy and favorable decisions will be secured, thus justifying your claim to the possession of the only practical system of incandescent lighting.

Your attention is invited to the balance sheet herewith, from which it will be seen that the net profits on business completed during the ten months ending November 1st, 1884, have been $60,-248.62.

The great depression in business throughout the country has, however, affected some customers whose accounts were taken

over from last year as good. As your Board has not thought it expedient to carry forward any assets of doubtful value, all these accounts have been written off to Profit and Loss, although some considerable portion of them will, in all probability, be eventually collected. In the same way losses, which were not anticipated on the 31st December last, have since been ascertained on certain experimental installations of the previous year, and these have also been charged off. The operations in 1884 have been sufficiently profitable to admit of all this, and still leave a small balance at the credit of Profit and Loss, and your capital is intact, with all depreciated or worthless assets written off. Consequently there appears no reason to doubt that, with the safer methods of business now followed, your company will be able in future to resume the payment of regular and satisfactory dividends.

The authorized capital stock of your company is the same as at the date of your last report, namely, $1,000,000, made up as follows:

Issued to Light Co. for license		$382,500 00
Paid for in cash		361,938 66
		$744,438 66
Unpaid installments		8,176 34
		$752,615 00
Still to be issued to Light Co. for license		127,500 00
Stock not yet called, viz., 50 % of $245,000.00	$122,500 00	
Less already paid in full	2,615 00	
		$119,885 00
Authorized capital		$1,000,000 00

By order of the Board of Trustees,

E. H. Johnson,

President.

65 Fifth Avenue, New York,
November 18th, 1884.

THE EDISON COMPANY FOR ISOLATED LIGHTING.

Dr. CONDENSED BALANCE SHEET. OCTOBER 31st, 1884. *Cr.*

License from Edison Elec. Light Co.			382,500 00
Property accounts:			
Roselle plant		$3,179 86	
Bijou Theatre plant (Boston)		8,776 75	
Exhibition plants		15,086 02	
Temporary rental plants		68,090 69	
Supplies on hand:			
New York	$93,325 00		
Philadelphia	1,537 59		
Baltimore	229 07		
Canada	8,627 59		
Albany	738 51		
St. Louis	14 54		
Boston	3,114 17		
		$107,586 47	
Office and store-room fixtures: New York, New England and Canada		4,272 78	
			$206,992 57
Open accounts:			
Edison Elec. Light Co.		$28,470 56	
Sundry accounts		21,742 08	
			50,212 64
Customers' acccounts for installations, completed			163,485 75
Bills receivable			7,320 71
Cash accounts			5,219 03
Work in progress			26,679 70
			$842,410 40

Capital Stock paid in cash			$361,938 66	
Issued and to be issued to E. E. L. Co. for license			*382,500 00	
				$744,438 66
Bills payable			56,722 05	
Accounts payable			35,225 01	
				91,947 06
Open accounts				4,762 48
Profit and Loss account:				
Credit bal'ce 1884, being net profit on work completed between January 1st, 1884, and November 1st, 1884, after deducting all expenses, depreciation of stock, &c.		$60,248 62		
Less Suspense a/c 1883	$19,170 92			
" accounts of 1883, charged to Profit & Loss, as explained in Report	39,815 50			
		58,986 42		
				1,262 20
				$842,410 40

* This amount will be increased to $510,000 whenever the remaining capital is called in.

List of Edison Isolated Plants

INSTALLED PRIOR TO OCTOBER 1ST, 1885,

IN THE UNITED STATES.

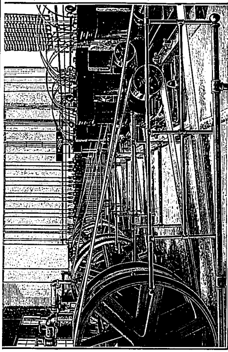
EDUCATIONAL INSTITUTIONS, PUBLIC ASYLUMS AND HOSPITALS.

Name.	Address.	Number of Lamps.
Bowdoin College	Brunswick, Me.	25
City of New York College	N. Y. City	32
Coasters' Harbor Island	Newport, R. I.	300
Columbia College	N. Y. City	309
Dr. Chamber's Women's Hosp.	N. Y. City	180
Deaf and Dumb Institution	Fulton, Mo.	326
Friends' School	Providence, R. I.	50
Ill. East'n Hosp. for the Insane	Kankakee, Ill.	678
Ill. North'n Hosp. for the Insane	Elgin, Ill.	659
Iowa State Penitentiary	Anamosa, Iowa	480
Iowa Agricultural College	Ames, Iowa	250
Iowa State Agricult'l Society	Des Moines, Iowa	200
Kans. State Asyl. for the Insane	Topeka, Kans.	880
Kans. State Penitentiary	Lansing, Kans.	576
Massachusetts State House	Boston, Mass.	150
Milwaukee Asyl. for the Insane	Wauwatosa, Wis.	800
Milwaukee County Hospital	" "	200
Miller Industrial School	Batesville, Va.	400
Michigan School for the Blind	Lansing, Mich.	300
Michigan State Prison	Jackson, Mich.	420
Northern Asyl. for the Insane.	Traverse City, Mich.	800
Princeton Col. (Prof. Young).	New Jersey	25
State Institution for the Deaf and Dumb	Jacksonville, Ill.	91
University of Missouri	Columbia, Mo.	310
University of Notre Dame	South Bend, Ind.	100
U. S. Military Academy	West Point, N. Y.	60
U. S. Naval Academy	Annapolis, Md.	50
Ward's Island Insane Asylum and Hospital	Ward's Island, N. Y.	900
Yale College (Dr. Wright)	New Haven, Conn.	25
	Total	9,077

HOTELS, APARTMENT HOUSES AND CLUB ROOMS.

Name.	Address.	Number of Lamps.
Apartment House, 51, 53, 55 Clark St.	Brooklyn, N. Y.	550
Balmoral Hotel	Mt. McGregor, N. Y.	260
Barrington Apartments	N. Y. City	150
Bates House	Indianapolis, Ind.	150
Beer's Hotel, Mrs. H.	St. Louis, Mo.	250

4,800 LIGHT STATION (EXCLUSIVE OF RESERVE).



EDISON CENTRAL STATION AT HARRISBURGH, PA.—4,800 LIGHTS.

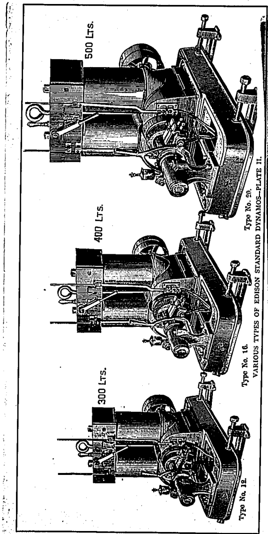
THE HARRISBURG EDISON CENTRAL STATION IS A TYPICAL

HOTELS, APARTMENT HOUSES, Etc.—*Continued.*

Name.	Address.	Number of Lamps.
Buckingham Hotel	N. Y. City	225
Calumet Club	Chicago, Ill	64
Carlton Club	N. Y. City	200
Dieter's Restaurant	Brooklyn, N. Y	250
Dakota Flats	N. Y. City	5,000
Everett's Hotel	Vesey St., N. Y. City	850
" "	84 Chatham St., N. Y. City	130
Franke's Apartment House	N. Y. City	850
Hotel Vendome	Boston, Mass.	68
Hotel Royal	New Orleans, La	320
Kinsley's Restaurant	Chicago, Ill	525
Murray Hill Hotel	N. Y. City	950
Manitou Iron Spr'g Co.'s Hotel	Manitou, Col	101
Mazzetti's Restaurant	N. Y. City	50
New York Athletic Club	N. Y. City	835
Osborne Apartment House	N. Y. City	1,100
Prospect House	Blue M't'n Lake, N. Y.	280
Plankinton House	Milwaukee, Wis	230
Rennert's Hotel	Baltimore, Md	800
Sagamore Hotel	Lake George, N. Y	400
St. Charles Hotel	New Orleans, La	150
Steinhard's Apartment House	N. Y. City	130
Stokes' Hoffmann Restaurant	Welles Building, N. Y. City	67
The Powers Hotel	Rochester, N. Y	200
	Total	13,100

THEATRES AND PLACES OF PUBLIC AMUSEMENT.

Name.	Address.	Number of Lamps.
Academy of Music	Chicago, Ill	150
Bijou Theatre	Boston, Mass	730
Chicago Opera House	Chicago, Ill	1,000
Columbia Theatre	" "	1,000
Conservatory of Music	Boston, Mass	920
Eden Museé	N. Y. City	800
Exposition Music Hall	St. Louis, Mo	3,500
Egyptian Hall	Philadelphia, Pa	650
Ford's Opera House	Baltimore, Md	417
Grand Opera House	St. Louis, Mo	550
Harry Hill's	N. Y. City	185
Koster & Bial's	" "	258
Lyceum Theatre	" "	900
Miner's Eighth Ave. Theatre	" "	275
" People's Theatre	" "	550
" Bowery Theatre	" "	275
McVicker's Theatre	Chicago, Ill	1,155
National Theatre	N. Y. City	193
Panorama Building	" "	250
Pope's Theatre	St. Louis, Mo	425
Third Avenue Theatre	N. Y. City	600
	Total	14,288

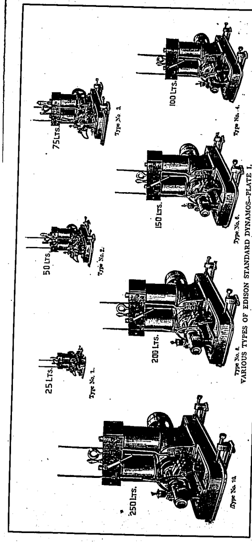


Type No. 12 Type No. 16 Type No. 20

VARIOUS TYPES OF EDISON STANDARD DYNAMOS—PLATE II.

BANKS, OFFICE BUILDINGS, STORES, RESIDENCES, &c.

NAME.	ADDRESS.	NUMBER OF LAMPS.
Astor Building	N. Y. City	1,858
Aitken & Co	" "	150
American Express Co	" "	360
" "	Chicago, Ills	285
Arnold, Constable & Co	N. Y. City	57
Adams Express Co	Boston, Mass	100
Baltimore Steam Packet Co	Baltimore, Md	169
Bartlett, Captain Joseph	Galveston, Texas	60
Boston Post Office	Boston, Mass	1,200
Brush-Swan Electric Light Co.	Norfolk, Va	150
Burnham Cottages	Lake George, N. Y	100
Chickering & Sons	Boston, Mass	174
Commercial National Bank	Chicago, Ills	103
Crawford & Bro	Middleton, N. Y	25
Counselman Office Building	Chicago, Ills	250
Chicago City Hall	" "	1,200
" La Salle St. Tunnel	" "	150
" Wash'gton St. Tunnel	" "	125
" Board of Trade B'ld'g	" "	859
Chi. & Minonk Coal & Coke Co.	Minonk, Ills	150
Cheltenham Improvement Co.	Chelt'ham Beach, Ills.	300
Cleaver, C. S	Silverton, Col	250
Darlington, Runk & Co	Philadelphia, Pa	455
Davenport Electric Light Co.	Davenport, Iowa	150
Doane, J. W. and others, Residences	Chicago, Ills	558
Drexel & Co	Philadelphia, Pa	220
Duncan Building	N. Y. City	250
Fairbanks & Co.	" "	144
First National Bank	Chicago, Ills	250
Fidelity Insurance Associat'n.	Philadelphia, Pa	75
Gorham Manufacturing Co	N. Y. City	274
Grand Central Depot	Cincinnati, Ohio	1,067
Grand Central Depot Annex.	N. Y. City	214
Huyler's Confectionery Store.	" "	123
Hulin, J. S	" "	50
Jaffray & Co., E. S	" "	500
Jackson Elec. Lt. & Power Co.	Jackson, Mich	500
Jordan, Marsh & Co	Boston, Mass	171
Johnson, E. H	N. Y. City	100
Kennard & Son	St. Louis, Mo	235
Laconia Elec. Light Co	Laconia, N. Y	200
Ladd & Logan	San Francisco, Cal	60
Lockport Gas Co	Lockport, N. Y	550
Markle, Jno. R.	Detroit, Mich	150
Merchants' National Bank	Chicago, Ills	150
Morgan, J. Pierpont	N. Y. City	400
Mandel, B. W	Chicago, Ills	800
Marshall, Field & Co	" "	410
McCarty & Son, D	Syracuse, N. Y	210
Metcalf Bros. & Co	Detroit, Mich	175
Mills Building	N. Y. City	600
Mills, M. D	Chicago, Ills	231
Myers & Co., J. G	Albany, N. Y	202
Milw. Exposition Asso. B'ld'g.	Milwaukee, Wis	370
125th Street Cable Road B'ldg.	N. Y. City	200
Oregon R.R. & Navigat'n Co.	Portland, Oregon	120
Park & Tilford	N. Y. City	260
Pardridge & Co., C. W. & E.	Chicago, Ills	310
Roselle Elec. Light Installat'n	Roselle, N. J	1,000



VARIOUS TYPES OF EDISON STANDARD DYNAMOS—PLATE I.

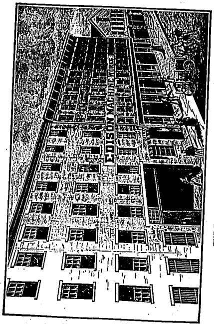
BANKS, OFFICE BUILDINGS, STORES, Etc.—*Continued.*

NAME.	ADDRESS.	NUMBER OF LAMPS.
Stern Bros	N. Y. City..............	180
Stager, Gen. Anson (Residence and others connected).......	Chicago, Ills...........	440
Second Ave. R.R. Car Stables	N. Y. City..............	312
Spencer, Trask & Co...........	Albany.....................	15
Taylor, O. N........................	Ludington, Mich......	60
Thomas, B. F.......................	Shelbyville, Tenn	60
Thompson. C. C..................	Canton, Ohio..........	25
Thomas, Crandall & Lee.......	Little Falls, N.Y......	500
Thurber, Whyland & Co.......	N. Y. City.......	330
Van Antwerp, Bragg & Co....	Batavia....................	101
Ward, S......	Circleville, Ohio.......	50
Western Edison Light Co......	Chicago, Ills............	600
White & Co., R. H...............	Boston, Mass...........	1,400
Wilshire Building................	Cleveland, Ohio.......	450
Yates & Co., A. C................	Philadelphia, Pa......	250
	Total...	24,027

NEWSPAPER AND OTHER PRINTING OFFICES.

NAME.	ADDRESS.	NUMBER OF LAMPS.
Albany "Journal" Co..... ...	Albany, N. Y........	89
Baltimore "Sun"...............	Baltimore, Md.........	282
" "American".......	" "	50
Beal, Junius E.....................	Ann Arbor, Mich.....	100
Boston "Daily Advertiser"...	Boston, Mass...........	182
" "Herald" Offices......	" "	600
Chicago "Daily News" Co...	Chicago, Ills............	183
Cincinnati "Daily Inquirer".	Cincinnati, Ohio.......	200
Clay & Richmond................	Buffalo, N. Y.........	25
"Courier" Company............	" "	120
Davenport "Gazette"..........	Davenport, Iowa......	120
"Daily Press & Knickerb'ker"	Albany, N. Y..........	86
"Detroit Free Press"..........	Detroit, Mich..........	100
"Detroit Post & Tribune"....	" "	150
"Gazette" Printing Offices..	Little Rock, Ark......	200
Government Printing Offices.	Washington, D. C....	600
"Globe-Democrat".............	St. Louis, Mo..........	231
"Galveston News".......	Dallas, Texas..........	100
"Kansas City Times".........	Kansas, Mo.............	200
Lockport "Journal"...........	Lockport, N. Y........	25
"New York Herald"...........	N. Y. City.......	700
New York "World"......... .	" "	450
"North'n Budget & Telegram"	Troy, N. Y.............	76
"Ohio State Journal".........	Columbus, Ohio.......	60
Philadelphia "Public Ledger"	Philadelphia, Pa......	850
Philadelphia "Record".......	" "	550
Rand, McNally & Co...........	Chicago, Ills...........	110
Russell, Morgan & Co.........	Cincinnati, Ohio......	250
Syracuse "Herald".............	Syracuse, N. Y.........	60
"Troy Times".....................	Troy, N.Y...............	51
Union Printing & Pub. Co....	Lockport, N. Y........	85
"Valley Sentinel"......... ...	Carlisle, Pa.............	81
Weed, Parsons & Co...........	Albany, N. Y..........	380
"Westliche Post"...............	St. Louis, Mo..........	125
	Total...............	6,981

ALL THE DYNAMO-ELECTRIC MACHINES USED IN THE UNITED STATES IN CONNECTION WITH THE EDISON SYSTEM ARE MANUFACTURED AT THE EDISON MACHINE WORKS.



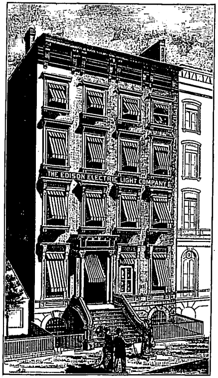
THE EDISON MACHINE WORKS, NEW YORK.

SUGAR REFINERIES.

Name.	Address.	Number of Lamps.
Boston Sugar Refinery	Boston, Mass.	125
Brooklyn Sugar Refinery	Brooklyn, N. Y.	655
Bay State Sugar Refinery	Boston, Mass.	150
Belcher Sugar Refinery	St. Louis, Mo.	828
California Sugar Refinery	San Francisco, Cal.	950
Canada Sugar Refinery	Montreal, Ca.	250
Halifax Sugar Refinery	Halifax, N. S.	200
Havemeyer & Elder	Williamsburgh, N.Y.	956
Harrison, Havemeyer & Co.	Philadelphia, Pa.	650
J. O. Matthiessen & Weichers	Jersey City, N. J.	1,200
St. Lawrence Sugar Ref'g Co.	Montreal, Ca.	200
	Total	5,664

FLOUR MILLS AND GRAIN ELEVATORS.

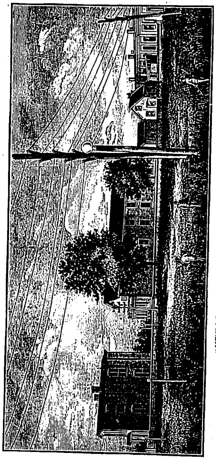
Name.	Address.	Number of Lamps.
Amos Bros	Syr.cuse, N. Y.	70
Anchor Milling Co	St. Louis, Mo.	80
Camp Spring Milling Co	St. Louis, Mo.	25
Central Milling Co	Niagara Falls, N. Y.	114
Cleveland Milling Co	Cleveland, Ohio.	60
Chester & Wilson	Lockport, N. Y.	25
Erie Elevator	Buffalo, N. Y.	150
Erie Elevator	Jersey City, N. J.	270
Empire Mills	Dallas, Texas	85
Gambrill Manuf'g Co	Baltimore, Md	74
Kauffman, J. C	St. Louis, Mo.	50
Kern's Flouring Mills	Milwaukee, Wis.	80
Lape & Brother	Cincinnati, Ohio	60
Lea, Sons & Co., Wm	Brandywine & Newcastle, Del	125
Myer & Bro., W. S	Westminster, Md	40
Norton Bros. & Co	Chicago, Ills	60
Norton & Co	Lockport, Ills	60
Pierson's Sons, S. B	Lawrence, Kan.	80
Pillsbury & Co. Chas. A	Minneapolis, Minn.	850
Sanderson & Co., E	Milwaukee, Wis.	60
Star & Cresent Mills	Chicago, Ills	68
Schaupp & Son. J. G	Grand Island, Neb.	25
Schoelkopf & Matthews	Niagara Falls, N. Y.	100
Sellers & Co., Wm	Melbourne, Pa.	70
Southern Flour Mill	St. Louis, Mo	75
Standards, E. O	St. Louis, Mo	81
Thornton & Chester	Buffalo, N. Y.	66
Urban & Co.	Buffalo, N. Y.	65
Victoria Flour Mills Co	St. Louis, Mo	25
Winona Mills	Winona, Minn	70
	Total	2,418



HEADQUARTERS OF THE EDISON ELECTRIC LIGHT COMPANY, NEW YORK.

COTTON, WOOLEN AND TEXTILE FABRIC MILLS.

NAME.	ADDRESS.	NUMBER OF LAMPS.
Arlington Mills	Lawrence, Mass.	180
Amer. Print'g and Dyeing Co.	Fall River, Mass.	200
Amory Mfg. Co.	Manchester, N. H.	800
Alberton Cotton Mills	Elysville, Md.	275
Arnold Print Works	North Adams, Mass.	150
Bates Manufacturing Co.	Lewiston, Me.	250
Bourne Mills	Fall River, Mass.	540
Broad Brook Co.	Broad Brook, Conn.	50
Carter, W. H.	Lowell, Mass.	80
Conanicut Mills	Fall River, Mass.	250
Clark Thread Mills	Newark, N. J.	125
Clark & Keen	Philadelphia, Pa.	250
Canada Cotton Co.	Cornwall, Canada	1,020
Continental Worsted Mills	Philadelphia, Pa.	400
Cochrane, Jr., John	Malden, Mass.	110
Columbian Mills	Southbridge, Mass.	100
Davol Mills	Fall River, Mass.	850
Durham Cotton Co.	Durham, N. C.	151
Eagle Cotton Mills	Madison, Ind.	800
Enterprise Mfg. Co.	Augusta, Ga.	600
Elwood, B. H. & E. E.	Fort Plain, N. Y.	54
Exposition Cotton Mill	Atlanta, Ga.	831
Fairmount Worsted Mills	Philadelphia, Pa.	550
Flint Mills	Fall River, Mass.	800
Germania Mills	Holyoke, Mass.	70
Givernaud Bros	Hackensack, N. J.	275
Givernaud Bros	Hoboken, N. J.	172
Givernaud Bros	West Hoboken, N. J.	412
Givernaud Bros	Homestead, N. J.	600
Goff & Sons, D.	Pawtucket, R. I.	350
Gary & Son, J. S.	Baltimore, Md.	801
Grinnel Mfg. Co.	New Bedford, Mass.	820
G. H. Gilbert Mfg. Co.	Ware, Mass.	400
Goulding, G. K.	Malden, Mass.	25
Garner & Co.	Wapp'ger'sFalls, N.Y	108
Hartford Carpet Co.	Thomps'nville, Conn.	60
Harrison, James	Newburgh, N. Y.	126
Hooper Twine and Net Co.	Mount'n Island, N.C.	800
Harder Knitting Co.	Hudson, N. Y.	160
G. P. Ide, Bruce & Co.	Troy, N. Y.	280
John P. King Mill Co.	Augusta, Ga.	705
Joshua Pierce & Co.	Bristol, Pa.	150
King Philip Mills	Fall River, Mass.	750
Laurel Lake Mills	Fall River, Mass.	400
Lockwood Co.	Waterville, Me.	850
Lorraine Woolen Co.	Pawtucket, R. I.	578
Merrimack Mfg. Co.	Lowell, Mass.	250
Merrick Thread Co.	Holyoke, Mass.	700
Mt. Vernon Co.	Baltimore, Md.	400
Montreal Cotton Co.	Valleyfield, Ca.	800
McAden, R. Y.	Lowell, N. C.	800
Medford Carpet Co.	Malden, Mass.	200
Minetto Shade Cloth Co.	Minetto, N. Y.	75
Montauk Mills.	Fall River, Mass.	150
Moratock Mfg. Co.	Danville, Va.	155
Madison Woolen Mills	Madison, Ind.	110
Nonantum Worsted Co.	Newton, Mass.	550
National Mfg. Co.	Nashville, Tenn.	150
Naumkeag Mills	Salem, Mass.	500
Old Kentucky Woolen Mill	Louisville, Ky.	350



"MENLO PARK"—THE BIRTHPLACE OF THE INCANDESCENT LIGHT.

COTTON AND WOOLEN MILLS, Etc.—*Continued.*

NAME.	ADDRESS.	NUMBER OF LAMPS.
Peacedale Mfg. Co	Peacedale, R. I	500
Pemberton Mills	Lawrence, Mass	305
Park Mount Cotton and Woolen Co. (Ld.)	Lenni, Pa	60
Packachoag Mills	Worcester, Mass	100
Rittenhouse Mfg. Co.	Passaic, N. J	65
Rodman Mfg. Co	La Fayette, R. I	60
Riverside Worsted Mill	Providence, R. I	174
Riverside Cotton Mills	Danville, Va	109
Rock Mfg. Co	Rockville, Conn	50
Seaconnet Mill	Fall River, Mass	400
Slater Cotton Co	Pawtucket, R. I	400
Sibley Mfg. Co	Augusta, Ga	600
Sayles & Washburn	Mechanicsville, Conn	300
Steinhard & Son, L	N. Y. City	40
Taylor, James	Newburgh, N. Y	150
Tingue, House & Co	Glenville, Conn	130
Taylor, Wolfenden & Co	Cardington, Pa	65
Wamsutta Mills	New Bedford, Mass	750
Worumbo Mills	Lisbon Falls, Me	700
Willimantic Linen Co	Willimantic, Conn	60
Wolfenden, Shore & Co.	Cardington, Pa	111
Worcester Corset Co	Worcester, Mass	200
York Mfg. Co	Saco, Me	750
	Total	25,806

PULP AND PAPER MILLS.

NAME.	ADDRESS.	NUMBER OF LAMPS.
Albion Paper Co	Holyoke, Mass	150
Albany P. W. & W. Paper Co.	Albany, N. Y	84
Cornwall Bros	Ann Arbor, Mich	25
Chemical Paper Co	Holyoke, Mass	150
Eau Claire Pulp & Paper Co.	Eau Claire, Wis	25
Fall Mountain Paper Co	Bellows Falls, Vt	650
Frambach Paper Co	Kaukauna, Wis	50
Glen Pulp & Paper Co	Hoosac Tunnel, Mass.	25
Hill, Rowland F	Niagara Falls, N. Y	25
HudsonRiverPaper&PulpCo		200
Howland & Co	Sandy Hill, N. Y	100
Herkimer Paper Co	Herkimer, N. Y	50
Janeway & Carpender	New Brunswick, N.J.	820
Kalamazoo Paper Co	Kalamazoo, Mich	85
Keeney, A. W	Rockford, Ill	25
Lockport Paper Co	Lockport, N. Y	60
Nixon & Co. W. H	Philadelphia, Pa	60
Newman, Warner & Elfelt	Minneapolis, Minn	60
Ohio Paper Co	Niles, Mich	50
PennsylvaniaPulp&PaperCo	Lock Haven, Pa	85
Pettibone Paper Co	Niagara Falls, N. Y	25
Portage Straw Board Co	New Portage, Ohio	150
Quigley, John F	Niagara Falls, N. Y	25
Rogers, H. J	Appleton, Wis	800
SusquehannaWaterPowerCo.	Conowingo, Md	51

AWARDS AND PREMIUMS

—TO THE—

EDISON SYSTEM.

PARIS, 1882.

AT the "International Congress of Electricians" at Paris, 1882, the highest possible award the Congress could give was a **Diploma of Honor,** that being higher than a **Gold Medal.** The final award to Mr. Edison, made by the several juries, was three diplomas of honor, two gold medals and a silver medal. Pursuant to usage, however, the Congress reserved the right to reorganize awards, so as to give to each exhibitor the highest award which he had received in any one class, and the Congress therefore approved the recommendations of the juries, and itself awarded a diploma of honor to Mr. Edison, the only one awarded for an incandescent electric light. In addition to the foregoing awards, Mr. Edison received from the French Government the decoration of Officer of the Legion of Honor. He had been previously made Chevalier of the Legion of Honor, but the higher rank of Officer was conferred on account of his exhibit at the Paris Exposition.

LONDON, 1882.

At the "International Electric Exhibition," 1882, held at Crystal Palace, London, England, Mr. Edison was awarded the **Only Gold Medal** for a complete system of Electric lighting.

CINCINNATI EXPOSITION, 1883.

The Prize of Five Hundred Dollars, for the best System of Incandescent Electric Lighting; **Gold Medal,** for the best Incandescent Electric Light; and **First Prize** for an Incandescent Lamp Dynamo, were awarded to the Edison Company, *being all the prizes they competed for.*

SOUTHERN EXPOSITION, LOUISVILLE, 1883.

Four Medals. (1) The best Incandescent Light System; (2) the best Dynamo for Incandescent Lights; (3) the best Electric Lamp for Incandescent Light; and (4) the best Incandescent Light. The following extract is from the Report of the Jury, dated November 9th, 1883:

"The tests of the Edison system are most satisfactory as to the efficiency of the various appliances, the steadiness of the light produced and the general results. It is a matter worthy of notice that during the hundred days of the Exposition with over 4,000 Edison lights burning, there was not at any time a suspension of light from failure of the appliances of the Edison Electric Lighting Company."

FRANKLIN INSTITUTE, PHILADELPHIA, 1884.

At the FRANKLIN INSTITUTE, PHILADELPHIA, 1884, lamp tests showed decided superiority in favor of the Edison lamp.

Many other awards and premiums were made to the Edison system at Vienna, Nice, Munich, Dresden, Turin, Milan and Berlin and everywhere else where exhibited.

Burgoyne's Print, 146-150 Centre St., N. Y.

NAME.	ADDRESS.	NUMBER OF LAMPS.
Van Nortwick Paper Co......	Batavia, Ills...........	168
Watson, H. F..................	Erie, Pa.................	85
West, Geo......................	Ballston Spa, N. Y...	150
Whiting Paper Co............	Holyoke, Mass........	135
Ypsilanti Paper Co..........	Ypsilanti, Mich........	65
	Total..............	3,383

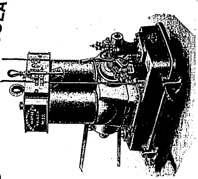
OIL REFINERIES, DISTILLERIES, DYE HOUSES, CHEMICAL WORKS & MEAT PACKING HOUSES.

NAME.	ADDRESS.	NUMBER OF LAMPS.
Ams, Max..........................	N. Y. City...............	65
American Oak Leather Co....	Cincinnati, Ohio.......	150
American Lubricating Oil Co.	Cleveland, Ohio.......	110
Best Brewing Co., Philip......	Milwaukee, Wis.......	270
Cassard & Son..................	Baltimore, Md.........	61
ChicagoPack'g&ProvisionCo	Chicago, Ill.............	175
Deland & Co......................	Fairport, N. Y........	200
Eastern Distillery Co..........	Blissville, L. I..........	50
Eastman Dry Plate Co.........	Rochester, N. Y.......	60
Eclipse Lubricating Oil Co...	Franklin, Pa............	25
Fairbanks & Co., N.............	St. Louis, Mo..........	170
Fall River Bleachery...........	Fall River, Mass......	100
Hammond, Jr., O................	Baltimore, Md.........	450
Mill Creek Distillery Co.......	Cincinnati, Ohio.......	60
New Orleans Refrigerator Co.	New Orleans, La.....	75
Polar Oil Co.......................	Bayonne, N. J.........	86
Queens Co. Oil Works.........	Blissville, L. I..........	100
Powers & Weightman.........	Philadelphia, Pa......	75
Sperry & Barnes.................	New Haven, Conn....	240
Squires & Co., J. P............	East Cambridge, Mass	180
Shafer, Jacob C..................	Baltimore, Md.........	110
Thurber & Co., H. K. & F. B.	Moorestown, N. J....	76
Turkey Red Dyeing Co........	Bellefonte, R. I........	50
Upton Glue Factory............	Peabody, Mass........	100
Vacuum Oil Works.............	Rochester, N. Y.......	100
Viaduct Mfg. Co.................	Baltimore, Md.........	120
Warren Chemical Works......	Hunters' Point, L. I..	60
Weldy & Co.......................	Tamaqua, Pa...........	25
	Total..............	3,302

WATERWORKS, RUBBER FACTORIES AND MISCELLANEOUS MANUFACTURING ESTABLISHMENTS.

NAME.	ADDRESS.	NUMBER OF LAMPS.
Anderson & Barr................	Philadelphia, Pa.......	25
Arkansaw Oil Co...............	Texarkana, Kas........	100
Arcadian Mineral Spring Co..	Waukesha, Wis........	25
Bache & Co., Semon...........	N. Y. City................	300

THE EDISON COMPANY FOR ISOLATED LIGHTING.



E. H. JOHNSON,
PRES. AND GEN. MANAGER.

F. S. HASTINGS,
SEC'Y AND TREAS.

No. 65 FIFTH AVENUE, NEW YORK.

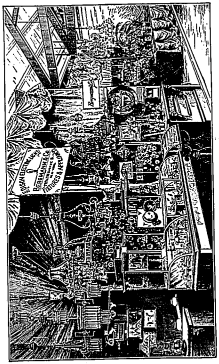
(1885)

WATERWORKS, RUBBER FACTORIES, Etc.—*Continued.*

NAME.	ADDRESS.	NUMBER OF LAMPS.
Belmont Pumping Station....	Philadelphia, Pa.......	65
Bowie, John..................	Manistee, Mich........	60
Boute & Co., G. H.............	Cincinnati, Ohio.......	51
Boston Rubber Shoe Co.......	Boston, Mass...........	78
Butters, Peters & Co............	Tallmann, Mich.......	60
Bergmann & Co.................	N. Y. City...............	600
Chapin, E. P......................	Providence, R. I.....	100
Calumet Fire Clay Co..........	Calumet, Ohio..........	150
Chauncey Rubber Co...........	Reading, Mass.........	50
Conglomerate Mining Co......	Lac la Belle, Mich. ..	77
Empire Salt Co...................	Greggsville, N. Y.....	30
Emerson, Fisher & Co........	Cincinnati,. Ohio......	75
Fischer & Co., B................	N. Y. City	60
Greenfield's Son & Co., E.....	Brooklyn, N. Y.......	108
Goldrie & McCulloch	Galt, Ont......	100
Holbrook & Co., H. J..........	Utica, N. Y.............	280
Holmes, P. C......................	Gardner, Me...........	73
Hawes, C. L...	Dayton, Ohio...........	100
Hepburn & Co., L. F....	Stratford, N. J........	50
Livezey & Co., J. W...........	Newport, Ky...........	50
Larrabee & Co....................	Albany, N. Y...........	200
Matteawan Mfg. Co.............	Matteawan, N. Y....	150
McLean, John R.................	Cincinnati, Ohio.	350
Morrison, A........................	do do	55
Mayall Rubber Co......	Reading, Mass........	105
Newton & Co...........	Albany, N. Y..........	75
Nichols & Co., A. S............	N. Y. City.............	80
New Bedford Cordage Co....	New Bedford, Mass..	186
Palmer E. D.......................	Richmond, Ind........	50
Philadelphia Water Works...	Spr. Gard., Phila., Pa.	205
Stetson & Co., J. B..............	Philadelphia, Pa......	560
Simonds, N. J.....................	Woburn, Mass.........	400
Schuttler & Hotz.................	Chicago, Ill............	25
Shaw & Bro., F...	Gr. Lake Stream, Me.	60
Smith, Bourne & Co............	Hartford, Conn..... ..	200
Sooy, Smith & Son, Wm......	Havre de Grace, Md.	25
Wolff & Co., R. H...............	N. Y. City..............	200
	Total..............	5,638

IRON WORKS, CAR AND MACHINE SHOPS, Etc.

NAME.	ADDRESS.	NUMBER OF LAMPS.
American Ship Building Co.	Philadelphia, Pa......	460
Avery, R. H. & C. M...........	Peoria, Ill...............	150
Allison, Robert....................	Port Carbon, Pa.......	100
American Wire Nail Co.......	Circleville, O..........	50
Baldwin Locomotive Works.	Philadelphia, Pa.....	75
Beckwith, P. D....................	Dowagiac, Mich.......	100
Burden Iron Works.............	Troy, N. Y.............	50
Carr & Hobson....................	Bergen Point, N. J..	120
Coleman, R. H....................	Cornwall, Pa..........	135
Chicago, Milwaukee & St. Paul R. R. Co. Shops........	Milwaukee, Wis.......	1,000
Cook Locom. & Mach. W'ks.	Paterson, N. J.........	175



BERGMANN & CO.'S EXHIBIT OF EDISON APPLIANCES AT PHILADELPHIA EXPOSITION.

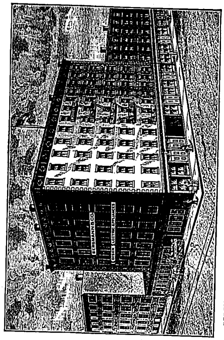
NAME.	ADDRESS.	NUMBER OF LAMPS.
Fulton Iron Works	Detroit, Mich.	50
Franklin " "	Port Carbon, Pa	60
Jenckes Mfg. Co	Pawtucket, R. I.	118
Lehigh Valley R. R. Co	Sayre, Pa	150
Manhattan R. R. Co	N. Y. City	140
Melone Sewing Machine Co.	Chillicothe, O	100
McKee & Fuller	Catasauqua, Pa	120
Midvale Steel Works	Philadelphia, Pa	100
McCormick Machine Co	Chicago, Ills	130
Mitchell, Vance & Co	N. Y. City	25
National Tube Works	McKeesport, Pa	65
N. W. Manufg. and Car Co	Stillwater, Minn	250
Novelty Iron Works	Dubuque, Iowa	60
Noye Mfg. Co., John T	Buffalo, N. Y	60
Otto Gas Engine Co	Philadelphia, Pa	25
Pottstown Iron Co	Pottstown, Pa	60
Pittsburg Electric Co	Pittsburg, Pa	50
Pullman Palace Car Co	Chicago, Ills	2,200
Stearns Mfg. Co	Erie, Pa.	250
Sanderson Bros. Steel Co	Syracuse, N. Y	100
Shaw, P. B	Williamsport, Pa	60
Southern Car Works	Knoxville, Tenn.	50
St. Paul & No. Pac. R.R. Co.	Como, Minn	383
Sweet Mfg. Co	Syracuse, N. Y	30
Trenton Iron Works	Trenton, N. J	254
U. S. Rolling Stock Co.	Chicago, Ills	60
" " "	Urbana, Ohio	120
Vulcan Furnace Co	Newbury, Mich	100
Western Nail Co	Belleville, Ill	240
Washburn & Moen Mfg. Co.	Worcester, Mass	107
	Total	7,087

FURNITURE AND PIANOFORTE MANUFACTORIES AND WOOD-WORKING ESTABLISHMENTS.

NAME.	ADDRESS.	NUMBER OF LAMPS.
Anson, Eldred & Son	Stiles, Wis	72
AnsonEldred Lum.&Mfg.Co.	Fort Howard, Wis	60
Alex'r Stewart Lumber Co	Wausau, Wis	60
Beatty, D. F	Washington, N. J	250
Boyce, James	Muncie, Ind	400
Bridgeport Organ Co	Bridgeport, Conn	300
Boston Chair Co	Ashburnham, Mass.	150
Dolge, Alfred	Dolgeville, N. Y	126
Hayward Bros. & Co	Gardner, Mass	310
Knabe & Co., Wm	Baltimore, Md	130
Lamb & Sons, A	Clinton, Ohio	150
Livingstone & Co., J. C	Little Falls, N. Y	53
Menasha Wooden Ware Co.	Menasha, Wis	140
Munson, Edgar	Williamsport, Pa	50
Oswego Mfg. Co	Oswego, N. Y	300
Phœnix Chair Co	Sheboygan	200
Richmond Cedar Works	Richmond, Va	106
Sechler & Co	Cincinnati, Ohio	25
	Total	2,882

BERGMANN & CO. MANUFACTURE ALL THE ELECTRIC LIGHT APPLIANCES FOR THE EDISON SYSTEM, SUCH AS

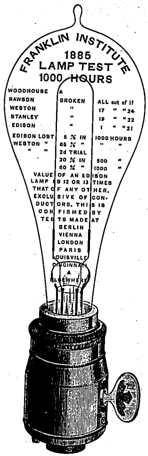
CENTRAL STATION APPARATUS CONTROLLING AND OPERATING DEVICES, ELECTROLIERS AND FIXURES OF ALL DESCRIPTIONS.



BERGMANN & CO.'S FACTORY, NEW YORK—MANUFACTURERS OF EDISON APPLIANCES.

NAME OF VESSEL.	OWNERS.	NUMBER OF LAMPS.
"Columbia"	O. R. and N. Co.	120
"Queen of Pacific".	do do	250
"Santa Rosa"	do do	450
"Olympian".	do do	280
"Alaskian"	do do	275
"Kalama"	Nor. Pacific R. R. Co.	60
"Mariposa"	Oceanic S. S. Co.	250
"Alameda"	do do	250
"Kinau"	do do	120
"Virginia"	Baltimore Steam Packet Co.	180
"Carolina"	do do	185
"City of Worcester"	Norwich Line	542
"Albatross"	U. S. Fish Commission	150
"Trenton"	U. S. Government	249
"Dolphin"	do do	172
"Mississippi".	do do	65
"New Hampshire".	do Naval Training Ship	230
"Namouna"	James Gordon Bennett	120
"Atalanta"	Jay Gould	180
"Nourmahal"	William Astor	184
"Electra"	Elbridge T. Gerry	120
"Fra Diavolo"	E. S. Stokes	25
"Pilgrim"	Fall River Line	920
"Bristol".	Old Colony Line	675
"Providence"	do do	675
"W. F. Nisbet"	Jefferson & Evansv. St'mb't Co.	41
"Kate Adams"	Mem., Ark. & Bends Packet Co.	120
"Benton McMillan"	Jefferson & Evansv. St'mb't Co.	87
"Osborne"	Illinois Central R. R. Co.	55
"Mascotte"	Detroit Dry Dock Co.	50
"Central"	New Jersey Central R. R. Co.	65
"Fanwood"	do do	65
"Plainfield"	do do	65
"Communipaw"	do do	65
"Elizabeth"	do do	65
"D. S. Miller".	Poughkeepsie Transfer C.	54
"Hasbrook"	do do	50
"F. P. James"	Albany & Troy S. S. Co.	32
"Algoma"	Canada, Pacific R. R. Co.	100
"Alberta"	do do	100
"Athabaska"	do do	100
"Seneca"	Old Dominion S. S. Co.	136
"Old Dominion"	do do	15
"Wyanoke"	do do	15
"Guyandotte"	do do	15
"Roanoke"	do do	15
"Louise"	Tolchester Steamboat Co	48
"Drew"	People's Line to Albany	75
"Dean Richmond".	do do	75
"Joppa"	Maryland Steamship Co.	62
"Baltimore"	Balt., Ches. & Rich. S. S. Co.	50
	Total	8,092

The Steamer "Columbia" heading this list was the first vessel ever lighted by the incandescent electric light, which also was the first commercial plant installed.



THIS RECORD SPEAKS FOR ITSELF.

RECAPITULATION.

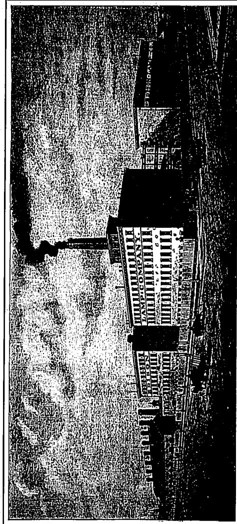
	NUMBER OF INSTALLATION.	NUMBER OF LAMPS.
Educational Institutions, Public Asylums and Hospitals:..............................	29	9,077
Hotels, Apartment Houses and Club Rooms	29	18,100
Theatres and places of Amusement...........	21	14,288
Banks, Office B'ld'gs, Stores, Residences, &c.	74	24,027
Newspaper and other Printing Offices......	34	6,981
Sugar Refineries....................................	11	5,664
Flour Mills and Grain Elevators..............	30	2,418
Cotton, Woolen and Textile Fabric Mills...	83	25,896
Pulp and Paper Mills	30	3,888
Oil Refineries, Distilleries, Dye Houses, Chemical W'ks and Meat Packing Houses.	28	3,862
Water Works, Rubber Factories and Miscellaneous Mfg. Establishments...........	41	5,638
Iron Works, Car and Machine Shops, &c...	41	7,987
Furniture and Pianoforte Manufactories and Wood-working Establishments	18	2,882
Steamships, Steamers, Yachts, &c............	51	8,002
* Total..	520	132,875

* All these, it should be borne in mind, are owned and operated by the purchasers themselves.

CENTRAL STATION LIGHTING.

The central lighting stations, operated by Edison companies and devoted wholly to the work of supplying lights to the general public precisely after the manner of gas, are as follows:

NAME OF CITY OR TOWN.	STATE.	NUMBER OF LAMPS.
New York (underground).	New York..................	18,000
Bellefonte do	Pennsylvania.............	1,200
Middletown....................	Ohio........................	700
Williamsport..................	Pennsylvania.............	4,500
Piqua	Ohio........................	1,200
Newburgh (underground)	New York...........	3,000
Tiffin	Ohio	1,200
Fall River......	Massachusetts............	3,000
Hazleton........................	Pennsylvania	1,200
Lawrence (underground).	Massachusetts............	4,500
Shamokin.......................	Pennsylvania	3,000
Brockton (underground)..	Massachusetts............	3,000
Circleville......................	Ohio	1,200
Cumberland....................	Maryland..................	1,200
Des Moines.....................	Iowa	3,200
Appleton	Wisconsin.................	2,000
Harrisburg......................	Pennsylvania	5,000
Westchester....................	Pennsylvania	2,000
Johnstown......................	Pennsylvania	1,200
Tamaqua........................	Pennsylvania	2,000



THE EDISON LAMP CO.'S FACTORY, NEWARK, N.Y.

CENTRAL STATION LIGHTING.—*Continued.*

NAME OF CITY OR TOWN.	STATE.	NUMBER OF LAMPS.
McKeesport	Pennsylvania	2,000
New Brunswick	New Jersey	2,000
Boone	Iowa	1,000
Wilmington	Delaware	2,000
New Bedford	Massachusetts	2,000
Berlin (underground)	Germany	14,000
Milan do	Italy	8,000
	Total	88,300
	Grand Total	221,175

This makes a grand total of 221,175, or, if the lamps actually placed in isolated plants were taken instead of merely the dynamo capacity, a grand total of upward of 300,000 Edison lamps in actual use.

PLANTS CONTRACTED FOR TO LIGHT EXHIBITIONS DURING THE YEARS 1884-5, IN THE UNITED STATES.

PLACE.	LAMPS.
Louisville, Ky.	5,000
St. Louis, Mo. (permanent)	3,600
New Orleans, La.	5,000
Cincinnati, Ohio	1,200
Boston, Mass.	1,200
Milwaukee, Wis.	800
Philadelphia, Pa. (exhibit)	3,000
Total	19,800

DIAGRAM SHOWING YEARLY INCREASE OF THE EDISON INCANDESCENT LIGHT IN ISOLATED PLANTS IN THE UNITED STATES.

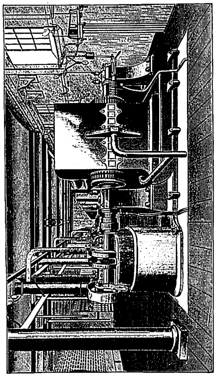
NUMBER OF LAMPS.

1885	132,875
1884	98,020
1883	64,850
1882	20,102
1881	5,122

PRINCIPAL EDISON INSTALLATIONS IN EUROPE.

ENGLAND.			
Wright, Turner & Son	Salford	Spinners	900
Mather & Son	Salford	Engineers	1,000
Moseley & Sons, D.	Manchester	India Rubber	1,000
Robey & Co.	Lincoln	Engineers	120
Theatre Royal	Manchester		500
Holborn Restaurant	London	Restaurant	1,000
House of Commons	Westminster	Dining-rooms & Libr'y	500
FRANCE.			
Poiret Frères et Neveux	Paris	Laines et Cotons	120
Opera Grand		Theatre	2,000
Credit Foncier,		Banque	100
Gagne-Petit		Magazins	500
Maison Hatchette		Ateliers de Reliure	400
Musée Grévin		Musée	300
Diorama		Diorama	200
Galeries, G. Petit		Exposit. de Tableaux	200
Banque de France		Impr. et Bureaux	1,200
Ecole Centrale		Ecole	200
R. Loeffel et Cie	Blainville	Filature de Cotons	400
Droulers-Vernier	Lille	Filature	400
GERMANY.			
Theatre Royal	Munich	Theatre	2,500
Residenz Theatre	Munich	Theatre	750
Gare Centrale, R. R. Station	Strasbourg	Gare	2,000
Union and Resorse Clubs	Berlin	Club	800
AUSTRIA.			
Stadt Theatre	Brünn	Theatre	1,960
Böhm. National Theatre	Prag		3,150
Union-Baugesellschaft		Café	440
Fr. Redlich	Brün	Tissage	380
ITALY.			
Municipio di Milano	Milan	Theatre	2,890
Societa del Teatro Manzoni			867
Cotonoficio Veneziano	Venezia		502
Signori Legnani, Marini		Hotel Continental	475
SPAIN.			
Gouvernement	La Carraca	Arsenal	500
Gouvernement	Carthagena		150
Labrador	Madrid	Usine	44
BELGIUM.			
Roy ainé	Ruysbroek		300
Philipps Glazers	Termonde	Couvertures Coton	114
Aimé Baboin	Saint-Vallier	Métiers à Tulle	50
RUSSIA.			
Finlayson et Cie	Tammerfors	Filature	800
L. Knopp	Moscou	Filature	250
Cie Josefow	Josefow	Sucrerie	200
MISCELLANEOUS.			
WesterSuckerraffinadery	Amsterdam	Sucrerie	378
Spakler et Tetterode			145
Palais du Roi	Stockholm	Palais	100
Theatre	Bucharest	Theatre	1,500
Station Centrale	Amsterdam	Station Centrale	1,000
		Total	32,875

MACHINES EVER BUILT ARE IN USE, HAVING A CAPACITY OF 1,000 LIGHTS EACH.



EDISON CENTRAL STATION AT MILAN, ITALY, 8,000 LIGHTS—NEW YORK, 12,000 LIGHTS.

IN THE NEW YORK, MILAN AND LONDON EDISON CENTRAL STATIONS THE LARGEST DYNAMO-ELECTRIC

Edison Electric Illuminating Company of Brockton

This folder contains printed material issued by the Edison Electric Illuminating Company of Brockton. This company was organized in February 1883 by William Lloyd Garrison, Jr. The plant commenced operation on October 1 of that year. It was the first underground application of Edison's three-wire distribution system.

The following item has been filmed: "Description of Edison Electric Light Plant, of Brockton, Mass." (1885).

4-A Electric Light - Central Stns.
Brockton
1885-03-24

DESCRIPTION

OF

Edison Electric Light

PLANT,

OF

BROCKTON, MASS.

W. J. Jenks

[From Electrical Review.]

Incandescent Electric Lighting;

WITH SPECIAL REFERENCE TO AND

DESCRIPTION

OF THE

EDISON ELECTRIC LIGHTING STATION

OF

BROCKTON, MASS.

BY

W. J. JENKS, Late Superintendent.

EDITOR OF THE ELECTRICAL REVIEW:

The world is beginning to realize that the problem of producing light by electric agency, for so many years the dream of scientific enthusiasts, is rapidly reaching so clear a solution that the public is not only to be generally interested in the improved illumination by the new methods, but will soon be offered a share in the management of numerous local enterprises, and the pecuniary advantage, which is now shown to be only a question of a short time.

The fact is perhaps not generally appreciated that two per cent. of the entire live capital of the country is invested in the business of illumination, a larger proportion than is represented by any other industry but that of transportation. The interest manifested through the columns of journals which, like the *Review*, have for some years devoted their energies largely to popular education in electric lighting, has shown of late that the time is ripe for presenting the prospects for future investment in this direction, so far as they are indicated by the outcome in plants only recently established.

The field of central station

LIGHTING BY INCANDESCENCE

is comparatively untrodden. In all the United States only four systems are in operation where the distribution of electric currents for light is effected through underground conductors after the general plan pursued by the gas companies. And as on this basis all large installations will doubtless be inaugurated, and to it all of much importance must come, it may be interesting to notice the general results, both favorable and unfavorable, realized in the old-

est of these four systems (outside the experimental plant in your own city) at

BROCKTON, MASS.

Here the Edison, as yet the only system of central station lighting by low tension currents, was offered to the public Oct. 1. 1883. As might reasonably be expected, some grave mistakes were made in the general policy first inaugurated.

For instance, in a manufacturing city where land (as near the centre of trade as the station of an incandescent plant should be) is valuable, and room with power is always at a premium, a building should always be so constructed that the second floor and those above may be readily rented. The extra cost of an additional story or two is insignificant as compared with the advantage secured during the early years of the enterprise. In Brockton a second floor, favorably located for a shoe factory, and the size of the original Edison station, 50x65 feet, rents for $300 to $500 per year, and power for $75 to $100 per H. P. The Edison building was however devoted only to the illuminating business, while the station of the Thomson-Houston company, 60x80 feet, since erected, has paid a good income on its entire cost by the rental of two floors with about ten horse-power, at upwards of $2000 per year.

Inexperience in the

MECHANICAL DETAILS

of installation resulted in faulty construction, especially in the vital matter of laying the underground conductors, and a reliable service was secured during the first six months in the face of electrical complications growing out of these errors, which have not been repeated in later systems, and need never be encountered in future.

The sectional boilers first installed have proved less economical and satisfactory than a tubular boiler added

last summer. Some reasons for this result will be noted later on.

An exhaust injector, supplying water from the street mains to the boilers against a steam pressure of 100 pounds, at a temperature of 150° to 160° was used for the first six months. Its intermittent action, necessitating constant watchfulness, proved a decided drawback to its usefulness where the duties of engineer, dynamo and regulator attendant and fireman, devolved upon one man. The use of the National heater, which was finally secured, effected a saving of 5 to 7 per cent. in fuel by supplying the feed water at 210° to 212°, the pump maintaining a nearly constant level in the gauges.

The attempt to use short belts obliged them to be run so tight that extra oil, of higher cost than would otherwise have been necessary, was demanded, and even then the loss of power was shown by a degree of heat at the bearings of the armatures, calling for a constant application of water, and accompanied, in the case of a heavy load, by a notable pulsation of the lights.

A SMALL INITIAL BUSINESS.

The wheels were started with a small number of lamps connected, less than one-quarter of the quota required to pay expenses, and at a time of year when the long hours of winter lighting when a meter system should show its best work, were so close at hand as to pass before this quota was secured, thus obliging a determined effort to increase rapidly the patronage in order to prevent the entire year's record from being unfavorable and discouraging.

Customers were expected, from the first, to bear the entire cost of wiring their residences and places of business, purchasing the earlier and more expensive styles of electroliers, or adapting their gas or other fixtures to the new light, even before the test of time had convinced the public of its reliability and adaptation to their necessities or convenience.

The Illuminating Company attempted to do their own

WIRING OF BUILDINGS,

and found themselves in the position which a gas company would occupy if endeavoring to carry on both the business of manufacturing gas and that of piping. To the exploiting of a rapidly growing industry, demanding all their best efforts, was added the care of a large stock of supplies and patented devices, and the necessity of meeting a demand for a special class of mechanics. It is not strange that in this department mistakes were made which have since been corrected at considerable cost. The result was the forming of a separate organization, to take the business of inside wiring entirely into their hands, latterly known as the New England Wiring Company. Acting in harmony with the Illuminating management this accessory body did good work in canvassing the field, securing customers in all directions, placing some of the most elaborate fixtures, and showing the most varied and attractive applications of the Edison system in Brockton's stores and residences, which are to be found in any American city. Finally, with increased experience in the intricate and often perplexing detail of the work, the Wiring Company extended its field from the strictly local basis on which it started, and within the past year has done varied service in Providence, Attleboro, Andover, Manchester and Boston for isolated plants, and at Laconia, N. H., for the nucleus of a central station system. Thus, as an outgrowth of disadvantageous circumstances, sprung an auxiliary which has proved a most valuable aid to the progress of the enterprise, and whose experience may be made available in future systems.

All the disadvantages here only hinted at combined to present so severe a test of the real money-making capabilities of the system that special force attaches to the fact that the legitimate running expenses of the station for the year ending September 30, 1884, together with some extraordinary outlays not likely to become necessary

in future, were paid by the income, and that the returns for the five months since that date indicate that a dividend will be earned the present year.

It will be readily understood that this result could not have been secured without intelligent and faithful management of the central station machinery, persistent efforts for the extension of the system and the increase of the number of customers, and watchfulness of the needs and preferences of all connected with the wires, and of the conditions which insure reliability of the service. Nor must the fact be overlooked that the business enterprise which always creates enthusiasm among Brockton merchants over the introduction of "a good thing," played no small part in the instantaneous success and rapid adoption of the new light. The experience now gathered, and applied the past winter to the operation of the system, will doubtless be fruitful of regularly gratifying results in future, and offer substantial encouragement to those debating the development of similar plants. A few other

SCRAPS OF HISTORY

and experience will perhaps be valuable to inquirers.

Number of 10-candle Lamps at starting station,	200
" connected Oct. 1, 1884, ...	2000
Population of Brockton, Jan. 1, 1885 (about)	20,000
Price of Gas, Oct. 1, 1883, ...	$2.25
Present price, ...	2.00

Price of 10-candle Edison Lamp (equivalent to average 5-foot gas burner) 1 cent per hour.

Cost of Power, (about) $60 per H. P., for the first year of 365 days of 10 hours.

Average H. P. used in light production for the year 1884, 365 days of 13 hours each, ... 40

Number of Edison 10-candle Lamps supplied with current, per indicated H. P., ... 10

CAPITAL AND EXPENSES

estimated for a 1600-light underground plant (corresponding with perhaps 3000 lamps actually installed) in a town or small city with fairly compact business district.

Capital, covering franchises for central station and isolated lighting, complete installation of plant with single set of machinery, and cash $5,000 for construction and other outlays during first year after starting station, ...	$55,000
Average Running Monthly Expenses of plant, when 2500 10-candle Lamps are installed, and 1000 in actual average use, say four hours every day (engines running from dark to daylight) :—	
Coal, 3 parts screenings, (say $3.25 per net ton,) and one part Cumberland, (say $4.75,) using Jarvis furnace, ...	$200.00
Oil and Waste, ...	17.00
Water, 125,000 gallons, say twenty cents per 1000 gallons, ...	25.00
Lamps, ...	150.00
Salaries, Manager, Metre man, Engineer and Fireman, say, ...	250.00
Average depreciation 5 % per year on $25,000,	104.00
Insurance, $20,000 at 1%	17.00
Taxes, ...	30.00
Incidentals, including meter supplies, $10.00, Telephone, $4.00. Stationery, $3.00, and Traveling, $5.00, ...	22.00
Monthly Total, . . .	$815.00
Gross Income, 4000 Lamp Hours per Day, .	$1200.00

Net Profit per year on this monthly average, 8½% on capital stock.

The above estimates, though based upon the experience of the Brockton plant, do not in several respects agree with the results there secured. They rather indicate what should be and what may be attained, under ordinary circumstances, if proper provision for reasonable economy is made in construction of the station.

THE ELECTRICAL MACHINERY

of the Brockton station has, in the main, proved so satisfactory as to leave little to be desired which in the present stage of scientific progress it seems possible to supply. Very recently some modifications of the 450 light dynamos have brought their capacity fairly up to 400 amperes and 125 volts, thus enabling them to provide for the loss of about 15 per cent. in feeders, mains, and inside wiring of buildings, and still maintain 800 10-candle Lamps requiring 110 volts to develop their normal light. The fact that this result is obtained while reducing the speed from 1200 to 900 revolutions per minute is one of the most gratifying recently brought out. This makes it possible to use 58-inch driving pulleys on the engine (in place of 66-inch) at 250 revolutions, and 16-inch on the dynamo (instead of 14-inch), and while retaining as available the normal power of the engine, and all the sensitiveness of its centrifugal governor, secure the maximum work of the dynamo with less heating of the bearings, less oil, and less wear of the commutator and brushes.

It has been objected to the methods of the Edison central stations that no automatic regulation is provided. Without doubt this will be secured, but those who criticize appear to forget that a compound winding, which some have loudly proclaimed as a panacea for all incandescent ills, simply aims to maintain a constant potential *at the dynamo*, (and of course practically, in isolated systems, throughout a building) while this is exactly what a central station machine must not do, as varying loads are accompanied by varying percentages of drop in electro-motive-force between the dynamo and the objective point, the lamp.

The delicate Edison indicator shows the watchful engineer a variation of 1 per cent. in the number of lamps in use, and in the case of a large theatre whose lights may

aggregate from 25 to 50 per cent. of the entire load on the system, it has been found convenient to use a special wire connecting a small signal bell and key on the stage with a mechanical gong at the station end, and enabling either party by a code of signals, to ascertain at any moment the circumstances of the other, and give warning of sudden changes.

The accuracy of the Edison meter system has been the subject of much doubt. Its practical operation has even been put upon the level of the incorrigible gauger of carburetted hydrogen. Without question it is as easy to make an electric meter lie as a gas meter, but it is certainly vastly easier to make it tell the truth. As a general rule customers do not growl. Numbers of them have kept track of their electric light consumption, making a daily note of the lamp-hours, and in some cases laying aside money for the payment of the bills. Such have uniformly been gratified at the accuracy of the meter record, and learned to put confidence in it, while it is as uniformly the case that the chronic growler knows nothing definite regarding his use of light.

The City Theatre, opened in October last, was the first in this country to be lighted by incandescent lamps by current from a central station metered like gas. The 500 lights distributed over the stage, auditorium, corridors, dressing rooms and approaches, form the only method of illumination, and as a matter of additional precaution, current is received from two services, drawing from the mains at points widely separated. In a smaller theatre since fitted, and in two large skating-rinks, well-grounded confidence has entirely excluded other methods of general lighting. The satisfaction realized as to quality and quantity is emphasized by the fact that after months of service by meter, the rinks have contracted with the Edison company for the season on mutually agreeable terms. The managers of the larger theatre, where the use of the light is intermittent, manifest no disposition to find fault with the meter bills.

The electrical conditions necessary for a perfect tube system have been so closely met, and the work of manufacture is now so carefully carried out, that in a year and a half of actual service no instance of trouble within the length of a 20-foot tube has ever arisen. Watchfulness of the mechanical work of laying these tubes and subsequent attachment of services will effectually prevent unsatisfactory working.

THE STEAM PLANT.

It would be difficult to find an engine better adapted to the exactions of central station work than the Armington & Sims automatic cut-off, with the latest improvements, including relief valves, preventing the possibility of accident from water in the cylinder. With fairly even pressure of steam, the regularity of its action under the sudden changes of load which constantly occur, is surprising, and when its full power is brought out in a case of short-circuiting of the main conductors, when in the twinkling of an eye its burden may be multiplied perhaps ten-fold, perhaps twenty-fold, its performance excites admiration and constitutes one of the safeguards of the system, enabling the dynamos to melt out the obstruction and continue their work. The high-speed engine, belted direct to the dynamo, may justly be regarded as one of the corner stones of the successful electric light station of the future.

The rapid growth of the system made it advisable last spring to reinforce the $8\frac{1}{2} \times 10$ engine running 350 revolutions, and the $14\frac{1}{2} \times 13$, speeded to 250 to 265, by a second machine of the latter size, with its accompanying 800-light dynamos. Closely following this came an increase of the boiler capacity of the station last summer. After careful consideration this was accomplished by the placing of a 125-H.P. steel tubular boiler by the Jarvis Engineering Company. This course was pursued because of the following unfavorable points developed by the two Babcock & Wilcox sectional boilers of 73 H. P. each, which were first supplied:

1. Slow action in raising steam. The tubular now in use shows 80 pounds (from cold water) from twenty minutes to half an hour sooner than the sectional.

2. Difficulty in recovering pressure when started downward by a sudden increase of load. This probably results from the extremely limited steam room, and small body of water exposed to the fire. Where, as in electric lighting, it is suicidal to stop the wheels during a run, this point becomes a vital one, especially when one man is charged with a variety of duties.

3. Uncertainty as to the level of the water. It has often happened that after opening the gauge-cocks, the water fails to reappear for some time, and leaves the fireman in suspense as to the real state of the case. The steam is also less dry and of course less effective than in tubular boilers.

4. Amount of care necessary. The frequent cleaning of the outside of the tubes by steam jet should be supplemented by periodical inspection of their interior, a task which, as the plugs which close them speedily rusted in, has become practically impossible in this station between the hours of shutting down in the morning and starting again toward night.

5. Greater economy of tubular form with Jarvis boiler setting. The tests made elsewhere, on which this judgment was based, were supplemented in December last by a very careful trial here, of which the following figures give the

COMPARATIVE RESULTS.

		Steel Tubular Boiler and Jarvis Furnace.	Babcock & Wilcox Boilers.
Date of Tests,		Dec. 3, '84.	Dec. 5, '84.
Duration of Tests,		16 h. 7 m.	16 h. 5 m.
Grate Surface,	Sq. Ft.	36	42
Kind of Fuel used,		1 part Soft Coal, 3 parts Screenings.	Clear Soft Coal.
Average Steam Pressure,	lbs.	85.16	87.22
Average Temperature of Feed Water,	°F	209.16	208.38
Pounds of Fuel consumed, { 200 lbs. wood figured equal 100 lbs. soft coal. } Screenings,	lbs.	2,250	
Pounds of Fuel consumed, Soft Coal,	lbs.	850	3,800
Pounds of Ashes and Refuse,		400	285
Pounds of Combustible,		2,700	3.315
Per Cent. of Ashes and Refuse,		12.9	7.5
Pounds Water Evaporated under Actual Conditions,		32,458	37,004
Equivalent Evaporation from and at 212°		33,724	38,521
Pounds Water Evaporated per pound of Coal under Actual Conditions,		10.47	9.74
Pounds Water Evaporated per pound of Coal from and at 212°		10.88	10.01
Pounds Water Evaporated per pound of Combustible Actual Conditions		12.02	10.53
Pounds Water Evaporated per pound of Combustible from and at 212°,		12.49	10.96
**Cost of Fuel consumed,		$5 85	$8.56
Pounds Water Evaporated @ 212° for $1.00 worth of Fuel,		**5,765**	**4,500**
Economy shown by use of Tubular Boilers, Jarvis Furnace and Screening Mixture.		22%	
H. P. developed by indication of Armington & Sims engines at comparative times.	5 o'clock, P. M.	96 H. P.	94 H. P.
	6 " "	96 "	105 "
	7 " "	92 "	92 "
{ From 9 P. M. until 7 A. M. the power varied, being at times as low as 10 H. P.	8 " "	104 "	112 "
	9 " "	104 "	128 "
Factor of Evaporation.		1.039	1.041

**Cost of Coal, { Soft Coal, $5.05 per 2240 lbs. Screenings, 3.50 per 2000 lbs.

PRACTICAL POINTS OF INTEREST.

The central station system shows in practice all the advantages of isolated plants with one or two important additional features. The steadiness of the light should in most cases be far superior, while the presence of duplicate boiler, engine, and dynamo power, guards against the liability of interruption which exists in isolated installations.

The Edison light is found to be almost equal to the arc in its power of discrimination in color and texture of goods. There are several Brockton merchants who affirm that they have no hesitation in matching, by the ordinary light in their stores, all but the most delicate of shades, and these are shown with great distinctness by the use of several lamps, or by a single lamp of high power, so arranged on the counter under an opaque shade as to cast its full brilliancy upon the goods close at hand.

Brockton shows some novel and beautiful effects in residence lighting, the arrangement of switches in some instances controlling all the lamps in the house from one or two central points, for greater convenience in case of fire or midnight visitations. Fascinating moonlight effects are produced by placing lamps on verandas, where the light will stream through open windows in the warm evenings of summer.

In a central engine house nearly forty lamps, in sleeping rooms and over steamers, are automatically lighted at the first stroke of an alarm, the same mechanism assisting to liberate the doors of all the stalls, and insure the immediate presence of the trained horses at the poles of the engine. One church has been fitted with elaborate fixtures, and in the halls, rinks and theatres the three-wire system has been carried into the larger electroliers, securing the control of half the lights at a time, as is often desirable, with a minimum outlay of wire and a double safeguard against interruption of the service.

HINTS TO PROMOTERS.

It may not be out of place in closing this already long

communication, to suggest a few points of importance to syndicates or individuals thinking of starting stations this year.

1. The choice between the overhead and underground plans should be determined by the feeling of the people regarding heavy pole lines in or near the principal streets, the existence of present lines or rows of trees, the feasibility of placing poles on private land along the rear lines of street lots, and the prospective size of the system. Very few cities can be adaquately served by overhead systems. Housetops should be avoided, and poles, when used, should be only from 90 to 110 feet apart, for heavy lines carrying feeders. The overhead conductors, if adapted to the place, will cost from one-quarter to one-third as much as the underground.

2. If you contemplate an underground system, come to Brockton if possible, and study the results where present knowledge has been gained largely by home experience. If an overhead installation is to be preferred, visit the plants in Pennsylvania or Ohio.

3. If an experienced manager is not available, secure during construction and the early month or two of operation, the best practical knowledge of the three-wire system which money will furnish. Don't make the mistake of attempting to cut running expenses the first year by using men of questionable ability. No well-informed Edison man is disposed, as Mr. Edison has well expressed it, "to make mysteries of plain things," but no Edison station will run itself and earn an enviable name. The care and judgment exercised in manipulating the station machinery, the meters, and the lamps, are of paramount importance to the early reliability of the service, and its lasting reputation. When numbers of good men have become familiar with the system, it will be time to choose between them. Get the best while the first few months' service is moulding public opinion.

4. If possible, combine the arc and incandescent systems under one management and one roof. One steam plant and one force of men can care for both, and

no better training for the handling of the dangerous high tension currents can be found than that which teaches the proper care of low tension conductors. If there is money to be made in electric lighting, it is to be found in a system where an arc lamp like the Thompson-Houston lights the street, and the Edison glows from the show-windows, while the same fires make steam for both, or the same turbine moves the common shaft.

5. One cardinal idea should be borne in mind in the work of construction. Selling lights by electric methods is, in effect, selling distributed power. Hence the first cost of power and the loss of it in transmission are most important factors in the grand result. It has been shown how the management of the Brockton station have succeeded in reducing the cost of their coal and increasing the efficiency of their steam plant. In the distribution of the current the principle enunciated by Sir William Thomson and others that "the additional running expense due to the resistance of conductors should equal the interest on their first cost" applies with certain modifications to the Edison system, and experience has shown what form those modifications should take.

6. Don't allow the spring to pass before your plans for this year are well outlined and in process of execution. The American capitalist, unlike his more moderate English cousin, is impatient for immediate dividends, and the results of the first year's run seem abnormally important to him. If a good showing is to be made for the year ending July 31, 1886, there is no time to be lost in getting started, for the land should be bought, conductors figured, made and laid, station built and equipped, and a good number of lamps wired for before the 1st day of August. Starting then, the machinery will be worked down to smooth bearings, the public convinced of the reliability and other merits of the light, and several hundred lamps connected by September 1st, when the harvest time of the incandescent plant commences. By April 1st of next year, if good judgment has prevailed and success has smiled, the list will be large enough to carry the expenses through the short hours of summer lighting, and the Edison system be shown to be a practical success with its patrons from the outset, and likely to insure a commercial return to its stock-holders within a reasonable period.

W. J. JENKS.

BROCKTON, Mass., March 24, 1885.

Edison Electric Illuminating Company of New York

This folder contains printed material issued by the Edison Electric Illuminating Company of New York. Organized in December 1880 to build generating stations in New York City, this company constructed the Pearl Street central station, which began operation September 4, 1882.

The following item has been filmed: "Annual Report" (1884).

EDISON ELECTRIC ILLUMINATING COMPANY OF NEW YORK.

REPORT

OF THE

BOARD OF TRUSTEES

TO THE

STOCKHOLDERS

AT THEIR

ANNUAL MEETING,

DECEMBER 9TH,

1884.

NEW YORK.
C. G. BURGOYNE'S "QUICK" PRINT, 146-150 CENTRE STREET.
1884.

BOARD OF TRUSTEES

WHOSE TERM HAS RECENTLY EXPIRED.

OFFICERS.

S. B. EATON, *Vice-President.*

F. S. HASTINGS, *Secretary and Treasurer.*

C. E. CHINNOCK, *Superintendent of Station.*

GENERAL OFFICES:

65 Fifth Avenue, New York City.

OFFICE OF FIRST DISTRICT STATION:

257 Pearl Street, New York City.

BOARD OF TRUSTEES

ELECTED DECEMBER 9, 1884.

OFFICERS.

SPENCER TRASK, *President.*

F. S. HASTINGS, *Secretary and Treasurer.*

C. E. CHINNOCK, *Superintendent of Station.*

GENERAL OFFICES:

65 Fifth Avenue, New York City.

OFFICE OF FIRST DISTRICT STATION:

257 Pearl Street, New York City.

To the Stockholders of

The Edison Electric Illuminating Company of New York City:

Your company has now completed the fourth year of its existence, and your Board feel that the results achieved are a fair cause for congratulation as to the past, and for encouragement as to the future.

Your enterprise was one of peculiar boldness. Starting almost from the moment that Mr. Edison had demonstrated the scientific success of his great invention, you undertook to apply practically, and to its fullest extent, a system which had scarcely been tried at all, except in the laboratory, and which, so far as underground and central station work was concerned, existed only theoretically. When the construction of the present central station was commenced, there were in use, perhaps, a half dozen small, imperfect isolated plants; and with only these to guide you, you undertook and have carried to scientific and financial success the great problem of underground central station lighting by electricity in competition with gas.

At the date of the last annual report, the First District had scarcely more than reached the point where its receipts were in excess of its expenses. During each and every month of the present year they have shown a handsome increase as compared with last year, and instead of a loss as in 1883, the operations of 1884 will leave a surplus of fully $3\frac{1}{2}$ per cent. on the capital stock, after paying expenses of every kind.

The following table shows in detail the average number of customers and of lamps connected, the collections, operating and general expenses (including all repairs and renewals), taxes, &c., and the profit or loss for each quarter of the years 1883 and 1884. It will be remembered that, prior to February 1st, 1883, the light was supplied as an experiment, free of cost to consumers.

Month.	Average of customers connected.	Average of lamps connected.	Collections.	Operating and general expenses.	Loss.	Profit.
1883.						
February, March	330	4,374	$3,788 64	$9,904 48	$6,115 84	
April, May, June	393	5,931	8,711 89	14,752 28	6,040 39	
July, August, September	439	8,685	15,689 01	15,197 31	....	$491 70
October, November, December	483	10,172	24,900 11	17,693 08	....	7,207 03
1884.						
January, February, March	498	10,685	28,659 34	18,229 88	....	10,429 46
April, May, June	541	11,594	25,400 54	18,148 97	....	7,251 57
July, August, September	582	12,503	23,849 34	19,975 88	....	3,873 46

The financial results of the foregoing table are summarized in the following:

	1883.	1884.
February and March	$6,115 84 loss.*	$10,429 46 profit.
April, May and June	6,040 39 "	7,251 57 "
July, August and September	491 70 profit.	3,873 46 "
October, November and December	7,207 03 "	14,000 00 "†
Net loss, 1883	$4,457 50	
Net profit, 1884	....	$35,554 49

*For two months only. The loss for three months would be even larger.

†The profits for December are estimated at $5,500 00
The actual profits for October and November were 8,500 00

Making the estimated total for the quarter, as above $14,000 00

As a matter of course, the profits of the station fall off considerably in the summer months, as will be seen from an examination of the foregoing tables. To neutralize this falling off in part, your Company has undertaken to furnish electric motor fans to be run by current from the central station, and while their introduction last summer was not possible until too late to secure any considerable results, the fans met with such favor as to warrant the belief that next summer they can be developed into an appreciable and permanent source of revenue.

A heavy item in the operating expenses of the First District has heretofore been that of lamp renewals. Owing to imperfect electrical determinations in the construction of the District, and the consequent inequality of electrical pressure, the lamp breakage was unduly heavy. It is very gratifying to state that during the past summer these defects of construction have been mostly corrected, and improvements have also

been made in the lamps themselves, with the result of raising the life of lamps from 400 hours of use in January to 914 hours in November, which is equal to a monthly saving of about $400 in operating expenses on the number of lamps in use at the present time.

The average monthly life of lamps during the past year, as reported by the Superintendent of the Station, has been as follows:

January	400 hours of use.
February	523 " "
March	349 " "
April	448 " "
May	400 " "
June	389 " "
July	502 " "
August	553 " "
September	727 " "
October	730 " "
November	914 " "

The following additions have been made to Construction Account of the First District since January 1st, 1884:

New plant, including 2 engines 150 H. P. each; 2 dynamos, 1200 lights each; 2 regulators, and expenses of installing same	$34,125 03
Station apparatus	1,123 01
Street conductors, viz.: 3,849⅔ feet	17,140 39
House connections and original lamps	2,958 41
Meters	133 31
Tools and implements	22 68
Motors	2,439 00
Office fixtures	59 33
Total	$58,001 16

The expediency of these expenditures, which have only been made after careful deliberation, is best shown in the financial results achieved, which are due in a considerable degree to the fact, that the increased expense of running the station as enlarged, bears but a small proportion to the increase of receipts secured by the enlargement. The station is even now taxed to its utmost capacity, and it is evident that further additions to the existing plant could be made with substantial advantage to the company. In fact, the Superintendent of the Station reports

that there are now on file over one hundred applications for the light, of which at least fifty, requiring about 750 lamps, would furnish very desirable customers.

Notwithstanding the recent reduction of the price of gas from $2.25 to $1.75 per 1000 cubic feet, our First District station has not yet lost a single customer, which is the best possible proof that our light, at its present cost (one and one-fifth cents per hour of use for lamps of 16 candle power), is found more desirable and satisfactory than gas even at the reduced price.

Of even greater importance, however, than the enlargement of the First District, is the question of starting a district up town. When your company was organized, it was believed that its authorized capital would be sufficient to install both an up-town and a down-town district, but the delays and difficulties encountered with the down-town district were so great, that the capital proved insufficient to install it alone, and even now your company finds itself in debt to the Light Co. for more than $70,000 for money advanced and balance of license, though against this your company claims certain offsets arising from the increased cost of the First District. In fact, the down-town district has been operated in the face of every possible disadvantage, but your Board has believed that it was pursuing the right policy in showing what could be done under all these unfavorable circumstances, hoping thereby to shorten the time when it could enlist the necessary capital for work up-town.

The present district, which is bounded by Wall street, Broad street, Exchange Place, Broadway, Spruce street, and the East River, is perhaps the least remunerative in the city, being occupied mainly by banking and other offices, which are closed on an average earlier than six o'clock, so that the hours of light consumption are very short. A far richer field for your enterprise would be an up-town district, extending perhaps from Twenty-third street to the Central Park, and

from the Eighth to Madison avenues. Not only would the hours of light consumption be much longer, but owing to the great cheapening now made in the cost of everything connected with the Edison system, the cash capital required entirely to install and equip a station of light giving capacity equal to the present one (and situated somewhere within the limits indicated), would be, as appears from preliminary estimates already made, not over one-half the amount spent for the down-town station. It is estimated that during the coming year this latter will earn fully five per cent. on its stock, or equal, in other words, to ten per cent. on the cost at which it could now be duplicated. In an up-town station, where there would be longer hours of light consumption, it seems very reasonable to assume that half again as much profit, or at least fifteen per cent. net per annum at the start, could be earned; and were it not for the general depression at present affecting all electric light investments, embracing both the good and the bad, your Trustees would not hesitate to come before you at once with some scheme to raise the capital for a large up-town installation. In all probability, considerably more than fifteen per cent. could be earned in an up-town district, but even on this basis it is felt that with the results already achieved in the First District, the time is near when a successful plan can be formulated for an up-town station, and as soon as one large station is started up-town there can be no doubt that the extension of the system throughout the entire City of New York will follow.

Your present capital stock is the same as at the date of the last report, viz., $1,000,000, made up as follows:

Paid in	$987,010
Unpaid Subscriptions	11,490
Stock in Treasury	1,500
	$1,000,000

The attention of shareholders is invited to the balance sheet herewith, which exhibits the condition of the company on October 31, 1884.

As the fiscal year of the company ends on the 31st December, it is recommended that the time for the annual meetings in future be changed to the third Tuesday in January, when the actual results of each previous twelve months can be presented in their entirety, without the necessity for partial estimates which at present exists.

By order of the Board of Trustees,
S. B. Eaton,
Vice-President.

EDISON ELECTRIC ILLUMINATING COMPANY OF NEW YORK.

CONDENSED BALANCE SHEET, OCTOBER 31ST, 1884.

DR.

License under Edison Patents..........		$350,000 00
Construction Account, First District:		
Real Estate..................................	$66,375 66	
Station Structures..............................	34,249 50	
" Apparatus..............................	128,623 05	
" " New Plant....................	34,125 03	
Street Conductors..............................	236,269 13	
House Lamps and Original Connections........	20,552 03	
Meters..................................	11,812 60	
Motors..................................	2,439 00	
Tools and Implements..............................	3,107 22	
Office Furniture and Fixtures....................	1,417 21	
Engineering Account..............................	19,241 99	
Experimental Account..............................	89,552 57	
Buildings Wired..............................	49,142 47	
Temporary Fixtures..............................	11,165 84	
Sundry Materials..............................	15,004 04	
American Steam Heating Co....................	1,307 41	
		724,384 75
Construction Account, Up-town Districts:		
New Buildings Wired..............................	19,399 65	
Canvassing Districts, No. 2 to No. 37........	6,305 99	
		25,705 64
Open and Property Accounts:		
Lighting Apparatus 65 Fifth Ave...$8,771 20		
Less written off for depreciation, &c. 4,000 00		
	4,771 20	
Cash..............................	2,762 18	
Moulds and Patterns..............................	136 50	
Supplies at Pearl Street Station....................	18,372 32	
Sundry Accounts..............................	5,681 87	
		31,724 07
		$1,131,814 46

CR.

Capital Stock Paid in..............................		$987,010 00
Accounts Payable..............................		11,749 71
Bills Payable..............................		10,139 00
Mortgage on Pearl Street Buildings....................		30,000 00
Edison Co. for Isolated Lighting....................		1,109 50
Edison Electric Light Co..............................		59,460 74
do. do. Special (Balance of License).		15,039 34
Profit and Loss..............................	$21,306 17	
Less written off from cost of Lighting apparatus at 65 Fifth Avenue............	4,000 00	
		17,306 17
E. & O. E.		$1,131,814 49

NEW YORK, Oct. 31st, 1884.

F. S. HASTINGS,
Treasurer.

Western Edison Light Company

This folder contains printed material issued by the Western Edison Light Company of Chicago, Illinois. Organized in May 1882, this company oversaw the installation of electric lighting plants in Chicago and throughout the Midwest.

The following item has been filmed: "First Bulletin" (1882).

No. 1.
SEPT. 12, 1882.

FIRST BULLETIN.

Western Edison Light Company,

SECRETARY'S OFFICE,

No. 51 & 53 WABASH AVENUE.

CHICAGO, September 12, 1882.

For the information of our Stockholders, I submit herewith a list of isolated contracts closed by the Western Edison Light Company since its organization:

NAME.	LOCATION.	SIZE OF PLANT.
Calumet Club House	Chicago	65 A Lamps.
Academy of Music	"	125 " "
C. W. & E. Pardridge & Co	"	310 " "
Norton Flouring Mill	"	15 " "
*Western Edison Light Co	"	250 " "
C. D. Seeberger	"	60 " "
N. K. Fairbank	"	105 " "
J. W. Doane, O. R. Keith, Edson Keith, Marshall Field	"	250 " "
H. J. Rogers	Appleton, Wis.	250 " "
A. E. Martin	Anamosa, Ia.	14 " " / 212 B "
O. N. Taylor	Ludington, Mich.	15 A "
Gazette Co.	Davenport, Ia.	120 B "

*The Western Edison Light Co. Plant will supply light to the different business houses in the block in which the Company's offices are located.

HOUSES WIRED READY FOR INSTALLATION OF PLANT.

Name.	Location.
J. R. Jones	Chicago.
T. R. Dent	"
Jos. Sears	"
H. H. Porter	"

There seems to be very flattering prospects for a large business this fall and winter in the isolated lighting department of this Company.

Everyone now using the light is thoroughly satisfied with its operation, and no doubt several of the above parties will increase their plant.

NEW YORK COMPANY'S PLANTS.

As very few parties are aware of the rapid adoption of the Edison Light, I include herewith a list of some of the principal parties who are using this light in the United States.

Considering the short time the Edison Light has been in the field as a competitor for the electric lighting business of the country, its progress has been phenomenal in the face of the numerous arc lights in the field.

Location	Name.	Size of Plant. A. Lamps.	B. Lamps.
Albany, N. Y	Spencer, Trask & Co	15	
" "	Weed, Parsons & Co		120
Augusta, Ga	Sibley Mfg. Co	400	
Blue Mountain Lake, N. Y	Prospect House		250
Brackett's Bridge	Alfred Dolge		126
Bergen Point, N. J	Carr & Hobson		120
Brooklyn, N. Y	Brooklyn Sugar Refinery	75	
Baltimore, Md	Steamer "Carolina,"	100 (10 candle.)	
Boston, Mass	Hotel Vendome	60	60
" "	Boston Herald	250 (10 candle.)	

Location.	Name.	Size of Plant. A. Lamps.	B. Lamps.
Cornell, Pa	R. H. Coleman	60	
Cincinnati, O.	J. L. Haven & Co	86	64
" "	Mill Creek Distillery	60	
E. Moorestown, N. J	Thurber Canning Works	60	
E. Boston, Mass	Boston Sugar Refinery		125
E. Cambridge, Mass	J. P. Squires & Co		130
Fullerton, Pa	McKee & Fuller		120
Fall River, Mass	Fall River Bleachery	45	40
" "	Borden Block	125	12
" "	King Philip Mill	705	
" "	Bourne Mill	500	
" "	Laurel Lake Mill	350	
" "	Conauticut "	250	
Glenville, Conn	Tingue, House & Co		130
Hudson, N. Y	Knitting Mill	150	
Holyoke, Mass	Merrick Thread Co		360
" "	Germania Mills		60
" "	Whiting Paper Co. Mill		120
Jersey City, N. J	Matth & Weichers		300
Kingston, N. Y	Peacedale Mills	250	
Lowell, Mass	Merrimac Mfg. Co		250
Lisben Falls, Me	Worumbo Mfg. Co		120
Lawrence, Mass	Pemberton Mills		250
" "	Arlington, 66	130	
McKeesport, Pa	National Tube Works		120
Newark, N. J	Clark Thread Co		125
Newburgh, N. Y	Jas. Harrison, Woolen Mills	60	
" "	Jas. Taylor, Cloth "		125
New Bedford, Mass	Wamsutta Mills	60	
" "	" " No. 6	750	
New Haven, Conn	Sperry & Barnes		240
New York, N. Y	Residence J. P. Morgan	250	30
" "	Residence J. H. Wright		125
" "	Everett Hotel	250	

Location.	Name.	Size of Plant. A. Lamps.	B. Lamps.
New York, N. Y.	Prof. Draper, Laboratory	15	
" "	Max. Am	60	6
" "	Atkinson & Co., Store	60	
" "	Hinds, Ketcham & Co., P'rs.		240
" "	Aitken, Son & Co., Store	36	36
" "	St'mship City of Worcester.	60	125
" "	Nathan & Dryfus		125
" "	Manhattan R'y Car Shops		120
" "	J. G. Bennett, Herald Build'g,		550
" "	" Yacht Namouna,		120
" "	E. S. Jaffrey & Co	140	
" "	H. K. & F. B. Thurber & Co.	250	
" "	American Bank Note Co.		125
Oregon Railway & Nav. Co	S. Ship "Columbia,"	120	
" " "	" "Queen of Pacific,".		250
" " "	Portland Docks	120	
Pawtucket, R. I	Slater Cotton Co.	325	
Passaic, N. J	Rittenhouse Mfg. Co		120
Paterson, N. J	Dunforth & Cooke, Loc. Wks.	60	
" "	W. Strange & Co., Silk Mill.	65	
Philadelphia, Pa	Philadelphia Record	250	
" "	Public Ledger	120	
" "	J. B. Stetson & Co., Hat M'y.	120	
" "	Baldwin Loco. Works	75	
Rochester, N. Y.	Eastman Dry Plate Co	15	
San Francisco, Cal	H. S. Crocker & Co., Store	60	
Saylesville, R. I	Lorraine Woolen Mill	400	
Stillwater, Minn	Seymour, Sabin & Co.		250
St. Johnsbury, Vt	Fairbanks & Co	60	
Trenton, N. J.	Trenton Iron Works	60	
Urbana, O	U. S. Rolling Stock Co.		125
Washington, D. C.	Record Room, Gt. P'tg Office,	125	
" "	N. J. Beatty, Organ Manf.		250
Waterville, Me	Lockwood Co	250	

Location.	Name.	Size of Plant. A. Lamps.	B. Lamps.
Winona, Minn	Winona Mill Co	70	
Winsted, Conn	N. E. Pin Co. Silk Mill	250 (10 candle.)	
Willimantic, Conn	Willimantic Linen Co	60	

The following plants have been installed by the Edison Company for Isolated Lighting.

McCormick Harvester and Machine Works, Chicago		130
Rand, McNally & Co, Chicago,		120
Marshall, Field & Co.,	"	60
Palmer House,	"	60
Jno. V. Farwell,	"	120
U. S. Rolling Stock Co.,	" (Shops)	125

STARTING OF THE FIRST CENTRAL DISTRICT, NEW YORK.

The Central Station in New York City was started Sept. 5th with perfect success.

One-third of the district has been lighted up, and about 5,500 lamps are in successful operation.

The balance of the district will be completed as rapidly as possible.

This will hasten the closing of contracts for franchises for Central Station lighting in this Company's territory; several cities already being under negotiation at the present writing.

There are now upwards of 20,000 Edison lights in operation in the United States, and an equal number in foreign countries.

These bulletins will be issued from time to time, as matters of interest to our stockholders may make it necessary, in order to keep them informed of our progress.

D. H. LOUDERBACK,
Secretary.

Extract N. Y. Herald, Sept. 5th.

EDISON'S ILLUMINATORS.

THE FIRST DISTRICT BRILLIANT WITH THE INCANDESCENT LAMP—THE ISOLATED SYSTEM IS IN SUCCESSFUL OPERATION.

In stores and business places throughout the lower quarter of the city there was a strange glow last night. The dim flicker of gas, often subdued and debilitated by grim and uncleanly globes, was supplanted by a steady glare, bright and mellow, which illuminated interiors and shone through windows fixed and unwavering. From the outer darkness these points of light looked like drops of flame suspended from the jets and ready to fall at every moment. Many scurrying by in the preoccupation of the moment failed to see them, but the attention of those who chanced to glance that way was at once arrested. It was the glowing incandescent lamps of Edison, used last evening for the first time in the practical illumination of the first of the districts into which the city had been divided. The lighting, which this time was less an experiment than the regular inauguration of the work, was eminently satisfactory. Albeit there had been doubters at home and abroad who showed a disposition to scoff at the work of the Wizard of Menlo Park and insinuate that the practical application of his invention would fall far short of what was expected of it, the test was fairly stood, and the luminous horseshoes did their work well. For a long time the company have been at work preparing for the lighting of the district. But there were obstacles to them which occasioned worrying delays. The insertion of meters had first to be attended to, and then came the inspection by the Board of Fire Underwriters. As there was but one competent expert encharged with this work, it naturally lagged, and it is still being pressed forward in places where the lighting apparatus is not yet ready. Then there were difficulties to be encountered in the laying of the wires and the establishment of connections. So, many people shook their heads at failure of the promised radiance, and believed something was amiss. The company went on untiringly, however, and last night it was fairly demonstrated that the Edison light had a very fair degree of success.

THE LAMPS AGLOW.

It was early in the evening that the current was first transmitted over the wires and the carbon horseshoes became aglow. The machinery worked well from the start, and the marked difference of the electric and gas illuminators was apparent at once. Some had based their ideas of the Edison light upon the pole electric light made familiar to them on the thoroughfares. They were a trifle disappointed at first when they saw the soft, mellow radiance of the incandescent lamp devoid of the anticipated glare and brilliancy. But when they came to remember that the light is to be used indoors for purposes of business where the eye would suffer from the too trying glow

—for the store, the counting-house, the workshop and for domestic uses, they came to appreciate how well the mellow yellowish light performed its functions. When the illumination was begun Mr. Edison stood in the workshop of the central office of the First District, at No. 257 Pearl street, in his shirtsleeves, superintending the work. Through the machinery the men flitted about as busy as bees. Messengers came speeding in to say all was ready, and then the complicated apparatus was set going, and in a twinkling the area bounded by Spruce, Wall, Nassau and Pearl streets, where the incandescent lamps had been introduced, was in a glow. There had been scientists who claimed the lighting of such a space by such a method an impossibility. But the result proved the contrary. Edison was vindicated and his light triumphed. Over the lighted area were big buildings like the Drexel and little stores tucked away in dark corners, but the communication nowhere failed, and the practicability of the multiple arc method was attested. All the lights in this space were not started last evening. In some places only a few of the number in readiness for lighting were wanted, but about three thousand were aglow, and if everything goes well, over five thousand illuminators will soon be in readiness for use. Among the larger buildings in this section where the light was used are the Drexel Building, *Times* Building, Polhemus', Barnes', Greene Sons, Washburne & Moore's, and others.

ACTION OF THE LIGHT.

As the evening progressed the action of the light was curiously watched by those who had it close to them. But it rarely lessened its strength, and for the first night the illumination, except in very odd instances, was singularly powerful and even. The group in the company's office seemed perfectly satisfied, and expressed a full conviction that once it was fairly set in operation there would be no interruptions. Mr. Edison said that he was convinced such would be the case did not any unforeseen and unknown phenomena intervene. Care would be taken to watch all influences that would offset the light, and doubtless new information tending to make it even more perfect would be gleaned. Altogether the experiment in district lighting was pronounced a success.

The other method of introducing the incandescent lamp has also been well received. In some of the buildings down town where an immense number of lights are used, the Edison Company for isolated lighting have put in their apparatus. They are able to put in plant in houses with a capacity of from fifteen lights upward. The HERALD building has the largest isolated apparatus for lighting in the city. In it are 609 lights, of which 500 were used for illumination last night. To supply them are used a Babcock & Wilson boiler and an Almington & Sims engine running with two of the 250 light dynamos, and with a capacity in boiler and engine to add three more dynamos. The isolated system of lighting has been intro-

duced in the American Bank Note Company Building, in Thurber's, E. S. Jaffray's, Everett's Hotel, Aitkinson's and Ams'. If the light is made of thorough avail, it is proposed, too, where great power is required, to introduce electric motors instead of steam.

[New York Tribune, September 5.]

ELECTRICITY INSTEAD OF GAS.

Many persons in the throng that pours down Fulton street every evening on the way to Brooklyn had their attention attracted yesterday to the lights in several of the stores on both sides of the street. In the place of the usual gas fixtures, were those of the Edison Electric Illuminating Company, each lamp shedding its light from a small blazing horse shoe that glowed within a pear-shaped globe, pendent beneath a porcelain shade. The company at 3 p. m., turned on the electric light in part of the first of the districts in which this kind of illumination is to be distributed, from a common centre. The first district is bounded by Nassau street, the East River, Wall street and Spruce street, Ferry street and Peck slip. The central station which supplies the electricity for the lamps in the different stores and offices is at No. 257 Pearl street, just below Fulton street. At this place last evening only two of the large engines of the six that are in the second story were in use. The services of the others will not be wholly needed, even when the entire district is lighted up.

At this station Mr. Edison, his chief engineer, Edward H. Johnson, and the other employes were found in a high state of glee at the opening of the electric-lighting system. Mr. Edison said: "We started our machinery this afternoon, and are now prepared to supply my light permanently to the district. The buildings of our customers have been inspected by the Board of Fire Underwriters, and as fast as the inspections are completed, the lights are put in. For the last two or three weeks the company has been busy testing its system of underground conductors, making connections with the buildings of its subscribers, and putting in fixtures and meters. Statements have been published recently from some electricians, to the effect that my system was utterly impracticable. We have proved to-day, already, that it is a success. The lights in the office of Drexel, Morgan & Co., half a mile away from the central stations, are burning as brightly as the lights here."

Mr. Johnson said: "We have the electric current flowing from Pearl street to Nassau street, and from Wall street to Spruce street. But actually we have only about one-third of the district lighted up to-night. There are eighteen miles of pipe laid and between 3,000 and 5,000 lamps are supplied. We have 16,000 lamps wired. In this district there are about 1,500 gas company subscribers. Out of that number we have secured 1,100 as subscribers. This station now is only half completed. When finished, and if we secure

the patronage of all the present users of gas, the station will supply the power for 22,000 lamps. The principal concerns that we have lighted up to-night, are Drexel, Morgan & Co., who have 100 lamps; Winslow, Lanier & Co., between 50 and 60 lamps; The Ansonia Brass and Copper Co., 100 lamps; Washburn, Moen & Co., 50 lamps; and numerous other smaller firms and places in Fulton, Pine, Wall, Nassau, Beekman and William streets, and Maiden Lane. There are no lamps lighted in Pearl street. Where we have not run the connecting wires into stores and offices, we have been prevented by the excavating work of a steam-heating company. Connections will be made as rapidly as possible, and it will not be many days before the lights have been furnished to the whole district. On Saturday we united all the feeding pipes that run from our station with our underground street system. Each of our machines here has a capacity five times greater than that of any similar machine ever before made. We will not need all of them to furnish the power for this district, and if one breaks down we shall be able to call in the power of the others that will not generally be in use, as a reserve. Consequently there will be no interruption in the supply of light to our customers."

Where the electric lights were in use last night the subscribers of the Edison Company expressed themselves as gratified with their brief experience with the new illuminating agent. The light was soft and perfectly steady, and appeared to distribute itself more evenly and uniformly than the light from gas-burners. The decrease in the heat caused by it, as compared with gas, was gratefully appreciated by the clerks who had to work beneath it.

[Extract from N. Y. Times, Sept. 5.]

EDISON'S ELECTRIC LIGHT.

"THE TIMES" BUILDING ILLUMINATED BY ELECTRICITY.

Edison's central station, at No. 257 Pearl street, was yesterday one of the busiest places down down, and Mr. Edison was by far the busiest man in the station. The giant dynamos were started up at 3 o'clock in the afternoon, and, according to Mr. Edison, they will go on forever unless stopped by an earthquake. One-third of the lower district was lighted up, the territory being within the boundaries of Nassau and Pearl streets and Spruce and Wall streets. During the past few weeks the Edison Electric Illuminating Company has been engaged in completing the installations in the premises of its customers by the insertion of meters and lamps, and in procuring inspection of such premises by the Fire Underwriters. As the Board of Underwriters has but one expert, Mr. Osborne, the progress has been necessarily slow, but such portion as has been inspected was supplied last night. Mr. Edison said that the work will be pushed as rapidly as possible, so that the rest of the district—that lying between Pearl street and the East River and Spruce and Wall streets, will soon be lighted. The laying of the steam-

heating pipes, Mr. Edison added, had interfered with some of the pipes of his company, and it might be necessary to-day to shut off the current in that portion of the district wherein The Times office is situated. The current would be shut off until his pipes could be shored up in that neighborhood.

Yesterday for the first time The Times Building was illuminated by electricity. Mr. Edison had at last perfected his incandescent light, had put his machinery in order, and had started up his engines, and last evening his company lighted up about one-third of the lower City District in which The Times Building stands. The light came in in sections. First there came in a series of holes in the floors and walls, then several miles of protected wires, then a transparent little egg-shaped glass globe, and, last of all, the fixtures and ground glass shades that made everything complete. They were temporary fixtures to give the light a trial, and so were put in with as little tearing and cutting as possible. To each of the gas fixtures in the establishment a bronze arm was attached, and the electric lamps were suspeaded from the ends of these arms. The lamp is simplicity itself. At the top is a brass circle, from which are suspended the shade and the lamp proper. The latter is a glass globe about four inches long, and the shape of a dropping tear, broad at the bottom, narrow in the neck, in which is inclosed the carbon horseshoe that gives the light. The globe is air-tight, and the air has been exhausted, leaving the carbon horseshoe in a perfect vacuum. When the thumbscrew is turned, and the connection with the electric wires is thus formed, the electric current makes this carbon so brilliant that it would be unpleasant to look at. It is not intended to be looked at, however, being entirely hidden by the ground glass shade. The whole lamp looks so much like a gas-burner surmounted by a shade that nine people out of ten would not have known the rooms were lighted by electricity, except that the light was more brilliant than gas and a hundred times steadier. To turn on the light nothing is required but to turn the thumbscrew; no matches are needed, no patent appliances. As soon as it is dark enough to need artificial light, you turn the thumbscrew and the light is there, with no nauseous smell, no flicker and no glare.

It was about 5 o'clock yesterday afternoon when the lights were put in operation. It was then broad daylight, and the light looked dim. It was not till about 7 o'clock, when it began to grow dark, that the electric light really made itself known and showed how bright and steady it is. Then the twenty-seven electric lamps in the editorial rooms, and the twenty-five lamps in the counting rooms made those departments as bright as day, but without any unpleasant glare. It was a light that a man could sit down under and write for hours without the consciousness of having any artifical light about him. There was a very slight amount of heat from each lamp, but not nearly as much as from a gas-burner—one fifteenth as much as from gas, the

inventor says. The light was soft, mellow and grateful to the eye, and it seemed almost like writing by daylight, to have a light without a particle of flicker, and with scarcely any heat to make the head ache. The electric lamps in the Times building were as thoroughly tested last evening as any light could be tested in a single evening, and tested by men who have battered their eyes sufficiently by years of night work to know the good and bad points of a lamp, and the decision was unanimously in favor of the Edison Electric Lamp as against gas. One night is a brief period in which to judge of the merits or demerits of a new system of lighting, but so far as it has been tested in the Times office, the Edison Electric Light has proved in every way satisfactory. When the composing rooms, the press rooms, and other parts of the Times building are provided with these lamps, there will be from 300 to 400 of them in operation in the building—enough to make every corner of it as bright as day.

Edison Electric Light Company of Europe, Ltd.

This folder contains printed material issued by the Edison Electric Light Company of Europe, Ltd. Organized in New York in 1880, this company controlled Edison's electric light patents in Europe, excluding the United Kingdom.

The following items have been filmed:

1. "Notes on the Formation of an International Edison Company" (1883?)
2. "International Edison Company. Articles of Association." (1883?)

The following items, also found in D-82-028 (Document File Series), have not been filmed:

1. "Translation of the Contract of November 15, 1881 between The Edison Electric Light Company of Europe, Ltd., and Messrs. [Charles] Porges and [Elie] Leon." (1882)
2. "Report of Messrs. [Theodore] Puskas and [Joshua F.] Bailey to The Edison Electric Light Company of Europe, Ltd. . . ." (1882)

NOTES

ON THE FORMATION OF AN

INTERNATIONAL EDISON COMPANY.

CAPITAL 30 MILLION FRANCS,

Divided in 60,000 Shares half Paid-up to Bearer.

LONDON:

PRINTED BY CHAMBERS & SONS, WILSON STREET, FINSBURY.

SYNOPSIS OF "NOTES" for formation of an INTERNATIONAL EDISON COMPANY for Electric Light and Motive Power.

Company to be formed under French law, admitting issue of shares to bearer on payment of 50 per cent. of nominal value.

Capital frs. 30,000,000, divided in 60,000 shares of frs. 500 each.

Preference dividend of six per cent. to capital.

All property, installations, contracts and business of the existing French Companies to be transferred, at cost price, to the International Company, the French Companies receiving in payment shares of the International.

The existing French Companies have the right to subscribe one-fourth of the capital of the new Company.

The balance of the capital to be distributed among syndicates formed in the several countries in which operations are to be carried on.

Shares to be printed in the German, English, French and Dutch languages and currency, and quotation to be had on London, Paris, Berlin and Amsterdam Exchanges.

Company to be administered by Board of Directors of say 20 members, made up from the several countries embraced in the exploitation.

The benefits reserved to Mr. Edison and his assigns are:—

(1). A royalty of 25 centimes (French) per lamp.

(2). 40 per cent. of the profits after payment of the preference dividend of 6 per cent. to capital.

The benefits reserved to the Syndicate subscribing the first capital are:—

(1). The profits from the sale of shares.

(2). 25 per cent. of the Parts of Founders coming to Mr. Edison and his assigns.

(3). The right to subscribe one quarter in all augmentations of the capital.

NOTES

ON THE FORMATION OF AN

INTERNATIONAL EDISON COMPANY.

CAPITAL 30 MILLION FRANCS,

Divided in 60,000 Shares half paid-up to Bearer.

PAYMENTS FOR PATENTS.

In payment of the EDISON Patents having relation to the Electric Light and to the transmission of motive power, there is to be allowed to Mr. EDISON or to his assignees, 30 centimes per lamp manufactured, employed, or sold by the Society, and 40 per cent. of the profits after the deductions provided for hereinafter.

OBJECTS OF THE SOCIETY.

(1.) Installation of Central Stations selling light to subscribers at a fixed price and by measure.

(2.) Isolated installations exploited by the Company itself.

(3.) The sale of isolated installations and of lamps.

(4.) Manufacture of machines, lamps, &c.

(5.) The sale of patents and of licenses and the constitution of Sub-Companies, subject to the conditions expressed in the Articles of Association.

CENTRAL STATIONS.

An opinion may be formed as to the probable profits of this branch of the business of the Company by the aid of the estimates prepared by our engineers, and joined to this paper for a Central Station at the Bon Marché, and another at the Rue Basse du Rempart, near the Grand Opera.

The prices paid for electric material in these estimates are those at present paid to the Edison Factory near Paris, but it can be conclusively shown that these prices are 25 per cent. higher than those at which the material can be actually delivered.

This is due to the fact of the recent establishment of the Edison Factory at Ivry, the prices of which with these orders in hand would be reduced at least 25 per cent.

The expenses of exploitation are also calculated at the highest figure possible, and the lighting power of the Standard Lamp A. is reckoned as only equal to 180 litres, though in reality, owing to the possibility of a better disposition of the incandescent lamp than is possible in the case of the gas jet, the Standard A. lamp of 16 candles is equal to the jet of gas consuming 200 litres.

In the estimates for the Basse Rempart Station the average consumption of five hours is allowed for. But it is certain that the consumers who are to be furnished with light from this Station are principally theatres, restaurants, cafés and clubs, whose regular consumption is from six to seven hours per day.

The average of hours of consumption at the Bon Marché Station according to the estimates is 4½ hours.

Also the price of gas has been taken as the point of departure in these estimates, that is to say, six centimes per lamp A. and per hour. But it is evident that taking into account the great advantages that the Electric Light has over gas, above all for theatres, restaurants, cafés and clubs, a somewhat higher price may be charged than that paid for gas.

In these estimates the replacing of lamps is provided for at the price they cost to the Compagnie Continentale at the present moment, while this cost is certain to be reduced in the next three months by at least 20 per cent.

No account has been made in these estimates of the considerable profits that the Company will realize from the sale of motive power during the day.

The Central Stations of the Rue Basse du Rempart and at the Bon Marché are not isolated cases at Paris; several other Central Stations may be established with the same advantages; for example the Palais Royal offers at a nominal cost the ground for the establishment of a Central Station, supplying the Conseil d'Etat, the Theatre Français, the Palais Royal, and the great number of shops, cafés and restaurants that are to be found there, in all, more than 12,000 lamps in a very small space.

Another Station may be established between the *Variétés* and the *Gymnase* on the Boulevards, and another in the quarter of the *Chateau d'Eau* to serve the theatres of the *Renaissance, l'Ambigu, Port St. Martin, Folies Dramatiques*, and the numerous shops, cafés and restaurants in the respective vicinities.

No reference is made in this Memorandum to the numerous central station enterprises proposed, or in various stages of preparation, outside of Paris, in France and in other countries in Europe.

ISOLATED INSTALLATIONS FOR THE SALE OF LIGHT BY MEASURE, MADE AND EXPLOITED BY THE COMPANY ITSELF.

The estimates herewith submitted relative to an installation of 500 lamps at the Bon Marché show a profit of 65 per cent. This installation was made as a trial, and worked from Nov. 17, 1882, to April 30, 1883, at the price of five centimes per lamp and

per hour, equal to about 25 centimes per 1,000 feet of gas (five centimes less than the current price of gas at Paris), and with the above results. The Bon Marché now asks for an installation of two to five thousand lamps with a small diminution of price, and the contract is already agreed upon.

Installations may be made in the same conditions at the depôt of wines and liquors at the Quay St. Bernard, at the Printing House Chaix, at the depôt of Bercy, Eden Theatre, Trocadéro, Palace Theatre, and several other Theatres ; and at the Rue Daru, the Railway Stations of Paris Lyons and the Mediterranean, and many other places.

These installations will, according to the most careful estimates, based on actual exploitation, give an average profit of from 40 per cent. to 65 per cent. on the capital employed.

SALE OF ISOLATED INSTALLATIONS.

Since the constitution of the Edison Companies, 17th February, 1882, they have sold 106,175 lamps, and 287 dynamo machines, making a total invoice value of frs. 1,695,887 35 centimes.

During the first seven months after their organization, the French Companies were obliged to order all dynamos, lamps, &c., from New York, and at such prices that little profit was made except on lamps.

Also the French Companies sell to their Sub-Companies all material at factory prices, so that the profits on such sales figure in the returns of these Companies instead of those of the French Companies.

The lamps, except those sold to Sub-Companies, are sold at an average of frs. 6 each, and their cost to the French Company is frs. 2.50.

The dynamos bought from the factory at Ivry, except those sold to Sub-Companies, are sold at an average net profit, all

commissions deducted of 35 per cent., and a net profit of at least 20 per cent. is made by the factory, making a total net profit of 55 per cent. The prices can be reduced to the public 25 per cent. without diminishing the profits of the Company owing to the fact mentioned in paragraph three of the foregoing section on "Central Stations."

The total profit of the of *Société Electrique* from the sale lamps, dynamos, &c., for the last six months, has been in round numbers frs. 150,000.

The results gained have been without attempts at publicity, and against the difficulties incident to a new organization in a business where there was no guidance to be obtained from the experience of others. Engineers were without experience and have had to be instructed; installations have been made at abnormal cost for time and expenses of engineers, losses from defective material and irregular shipment. But though the profits on material sold have been largely absorbed by these incidents of an exploitation wholly novel, there has not been a single case of failure or of accident, and no installation has been made to which reference cannot be made with confidence.

The demands for these installations are constantly increasing in all parts of Europe, and it is difficult to place a limit to the extension of the business in this direction.

There exist for example in France alone about 12,000 manufacturing establishments which have motive power, and which would find economy and security in using the incandescent light.

Private houses and chateaus also offer a good field, as yet untouched, for development, through the use of the perfected gas machines and other small engines which are now being brought into practical shape.

Independently of the profits that the Company receives from the sale in the first instance of isolated installations and of lamps, it is necessary to remark that every isolated installation gives a certain average yearly sale of from 50 to 500 lamps, and that every lamp gives a profit of about 3 Frs.

MANUFACTURE.

Manufacturing was first commenced at the factory regularly at the commencement of the month of August, 1882, and the first deliveries of machines were made at the beginning of the month of September, 1882.

The factory has been in operation then just one year. The *Compagnie Continentale* and the *Société Electrique* have during this time given the factory orders to the amount of 1,191,909 frs. 35 centimes.

Orders for more than 43 per cent. of this sum, to wit frs. 516,590 80 centimes, have been given during the last four months, May, June, July and August.

The *Compagnie Continentale* and the *Société Electrique* have bought, since their constitution on the 17th February, 1882, either from the factory at Ivry or from New York, a total of 303 dynamos, of which 287 have been sold to date. They have bought from the factory or from New York 137,863 lamps, of which 106,875 have been sold.

The Dynamos sold were as follows :—

6	C.	1200	A. lamps each
57	K.	250	" " "
18	L.	150	" " "
148	Z.	60	" " "
58	E.	17	" " "

Since the factory at Ivry commenced working it has received as above shown an average of orders of one hundred thousand francs per month. This amount will be more than tripled by the central installations that are now being prepared, and by the regular increase in the sale of isolated plants.

The minimum of profits realized on the manufacture is 20 per cent., and the balance sheet shows profits up to December 30th, 1882, of frs. 68,714·57 and from December 31st, 1882, to June 30th, 1883, of frs. 56,787·74.

EXPLOITATION.

Mr. Edison brings to the Company the patents for the following countries :—

France and her colonies
Belgium
Denmark
Austria Hungary
Russia
Italy
Spain (except her colonies)

and the considerable exploitation already established in Holland, Switzerland and Greece.

The Compagnie Continentale Edison actually existing, has sold the patents for Germany on the following conditions, to wit, 31¼ centimes for each incandescent lamp employed; 15 frs. for each horse power on all machines of less than 50 horse power, and 20 frs. per horse power on each dynamo of 50 or more horse power; and finally 21 per cent. in the profits of the Company after the sole deduction of 6 per cent. to the Shareholders.

This contract will be transferred to the International Company.

Offers have been made to the *Compagnie Continentale* by a group of bankers, to organize a Company for Austria on similar terms to those above of the German Company.

A provisional contract has also been signed for the creation of an Italian Company, with a first capital of frs. 6,000,000, from which frs. 600,000, in fully paid up shares, is to be given to the *Compagnie Continentale*; also a royalty of 25 centimes per lamp, and a royalty of frs. 12 per horse power on every dynamo employed either for light or motive power, and 15 per cent. of all augmentations of capital in fully paid-up shares. These contracts if realized before the date of the constitution of the proposed Company will be transferred to it.

Attention is called to the fact that, of the different forms of

exploitation proposed for the International Company, three are already demonstrated as giving a profitable employment for capital, viz.:—

(1). Manufacturing
(2). Sale of isolated plants
(3). Exploitation of isolated plants

The exploitation of central stations is the only employment for capital proposed in which an absolute demonstration based on current business cannot be given of the percentage of profits that can be realized.

But the installation and exploitation of the central stations at New York and Milan, now offered for examination afford data that it is confidently asserted, take this form of exploitation out of the category of doubt, and establish its practicability with large assured profits after discounting against it every element not absolutely determined.

It will be remarked that the cost of material has been put in the estimates for central stations at 25 per cent. more than the cost at which it can be manufactured to-day, and that every element of detail has been taken against the exploitation. The result reached in this way is so extraordinary that, even if it be reduced by one half, no more tempting field for the employment of capital can be found.

Attention is specially called, as an important element in the proposed affair, to the prices of gas on the continent, and to the fact that the municipalities whose dispositions are everywhere favorable, are nowhere hampered by general legislation.

In Paris, with coal at 30 francs, we have the present price of gas at 30 centimes the metre cube=frcs. 8.49 per 1000 feet. This price will probably be reduced to 25 centimes,=frcs. 7.08 per 1000 feet, at no remote date. In other cities in France the price varies from 30 cents. to 50 cents. per metre cube, that is between frcs. 8.49 and frcs. 14.16 per 1000 feet.

In Italy, at Turin, with coal at frs. 30, the gas is at 25 centimes the metre cube, equal to frs. 7·08 per 1000 feet. This is the lowest

price in Italy. At Milan and other cities, with coal at from 38 to to 42 frs. delivered at factory, gas is from 35 to 55 centimes, equal to frs. 9.91 to frs. 15.57 per 1000 feet.

In St. Petersburg, with coal at frs. 26.50, gas is 28 centimes per metre cube, equal to frs. 9 per 1000 feet.

In Madrid, with coal at frs. 45 to frs. 50 per ton, gas is sold to the Municipality at 25 centimes, and to private persons at 43¾ centimes per metre cube, equal to frs. 12.32 per 1000 feet. In other cities it varies from 42 cents. per metre to 55 cents.

In Belgium, with coal at from frs. 13 to frs. 15, delivered at place of consumption, gas is sold at from 20 to 30 centimes per metre cube, equal to frs. 5.66 to frs. 8.49 per 1000 feet. In two suburbs of Brussels and at Gand only the price is 15 centimes per metre cube.

In Germany, with coal at frs. 12.50 to frs. 25.00 per ton, gas is sold at from 19 centimes to 30 centimes per metre cube, equal to 4/6½ to 8/- per 1000 feet.

Price of coal in Amsterdam	...	frs. 28.40	per ton
„ gas „ „	...	„ 0.20	„ cubic metre
„ coal „ Rotterdam	...	„ 32.40	„ ton
„ gas „ „	...	„ 0.20	„ cubic metre

In Austria, with coal at from to per ton, gas is sold at from to per metre cube, equal to per 1000 feet.

EMPLOYMENT OF FIRST CAPITAL.

In illustration of the profit with which the capital here proposed can be employed, it is necessary only to consider business now in course, or that is prepared for execution at Paris and the profits that can be realized during the first twelve months after the organization of the proposed Company.

It is proposed to employ at Paris immediately on its organization

frs. 3,000,000 in the Rue Basse du Rempart; frs. 2,000,000 in the purchase of the factory, plant and material at Ivry; frs. 2,000,000 in isolated installations from which light is sold; and frs. 500,000 in material for isolated installations sold to purchasers, making a total of frs. 7,500,000.

The isolated installations for the sale of light to the amount of frs. 2,000,000 can be mounted in Paris, and in full operation six months after the constitution of the capital, so that six months income from them may be counted in the estimate of profits the first year.

The orders growing out of the proposed installations for Central Stations and for isolated plants for the sale of light by measure, proposed to be made as above, would together, at a very moderate figure, amount to frs. 2,500,000. On this amount we may fairly estimate a profit of 20 per cent. in allowing at the same time a reduction of cost from improved facilities and large orders.

The *Société Electrique* has made a profit on material sold of frs. 150,000 the last six months, and it may therefore be safely said that with the natural increase of the business and the improved facilities and organization, a net profit may be made of frs. 300,000 on the sale of isolated plants the next year.

We should thus have on the employment of frs. 7,500,000 the following profits in the first twelve months; estimating the profits on isolated installations for the sale of light at only 40 per cent. with six working months:—

Frs. 2,000,000 Isolated Installations for sale of light, earning during six months at 40 per cent per annum	frs. 400,000
Profits from factory, 20 per cent. on orders for frs. 2,500,000...	500,000
Profits from sales of material for isolated plants	300,000
Interest at 4 per cent. on frs. 8,000,000 ...	320,000
Total frs.	1,520,000

It is thus seen that a dividend of 10 per cent. is assured for the

first year on the total capital paid-up without going outside of Paris, and supposing frs. 8,000,000 to be earning only Bank interest.

It is also assumed that the frs. 3,000,000 invested in the Basse Rempart Central Station, earns nothing the first year, during a part of which it will be in preparation.

But as a matter of fact more than the amount proposed to be invested at Paris (Frs. 2,000,000) in isolated installations for the sale of light, can be invested at once in Spain, Belgium, Russia and Austria, and in France outside of Paris, a considerable part of which will yield larger profits than the frs. 2,000,000 invested in installations above proposed to be made in Paris.

It is to be noted also, that the *Compagnie Continentale* is offered a first payment of Frs. 600,000 from the Italian company, and this, as well as the royalty on lamps and machines, will enter in the first year's balance sheet. These amounts and profits derived from other local or national companies, will go to swell the receipts of the *International Company*, unless she shall find it more advantageous to keep the exploitation in her own hands.

The first capital proposed, in view of the magnitude of the field, is evidently moderate, and is calculated only for business that can be realized immediately on its constitution. The object of the above observations is to show, that this first capital will find an immediate and certain profitable employment, and to simply indicate the wider field, and larger profits that attend the employment of the quite incalculable capitals required for the fuller development of the affairs, which will only be well commenced by the capital now proposed.

The participation of the original subscribers in the profits growing out of the creation of these larger capitals is secured by the provision that they shall have the right to subscribe one quarter of all such increases, and by their participation in the Parts of Founder.

It is proposed that the *Compagnie Continentale*, and the *Société Electrique* transfer to the *International Company*, all the patents of Mr. Edison; the German and Italian contracts; all

contracts for Agencies; all material in depôt; all installations exploited for their account; property and furniture of offices at 33, Avenue de l'Opéra, and all business as it stands; and that the *Société Industrille* transfer its license, the land, buildings, installations, material, machines, &c.

Hereto annexed are:—

(1.) Complete list of patents, marked "A."

(2.) A statement of all property belonging to the *Industrielle*, *Continentale*, and *Electrique*, which will be transferred to the International, marked "B."

(3.) List of all installations made and sold by the *Continentale* and *Electrique* up to date, also of experimental installations made for demonstration, marked "C."

(4.) Balance Sheet of the Installation of 500 lamps worked at the Bon Marché between the dates of Nov. 17th, 1882, and April 30th, 1883, marked "D."

(5.) Estimates for Central Station (in two parts) at the Bon Marché, marked "E."

(6.) Estimates for Central Station, Rue Basse du Rempart, marked "F."

(7.) Notes of Professor Colombo on the exploitation of the Central Station at Milan, marked "G."

(8.) Copy of proposed Statutes of the International Company, marked "H."

(9.) List of names of shareholders of the French Companies, marked "I."

ORGANIZATION AND ADMINISTRATION.

It is proposed to institute a Board of Directors of 10 to 20 members taken from the several countries embraced in the field of operations of the Company.

Let it be noted that it is not proposed to organize a French Company, but an International Company under the French law.

The Board might be composed in the first instance, of say 12 or 14 persons taken from the several countries embraced in the field of exploitation of the Company. These would afterwards increase their number as they should find desirable.

It is believed to be indispensable that National organizations be formed in each country. The whole, or the greater part of the shares of such Companies should be subscribed and held by the International. The National Companies would have Boards of Directors made up from the persons heretofore active in the Edison affairs, with such others as it may be found expedient to join with them, and with the Director, or one of the Directors sitting on the Board of the International as President.

The Contracts between the International and the National Companies would fix their relations, and secure the unity of administration of all the National Companies, under the technical and administrative control of the International.

A Committee of the International Board would be constituted, who would have weekly meetings for the consideration of current administrative affairs. This Committee would send copies of the minutes of its proceedings to each member of the Board.

The entire Board of the International would hold its meetings once in three months, or at such intervals as may be found necessary.

The Committee should be limited in their power to vote during the intervals between such meetings, affairs involving the employment of more than a given sum, without the written consent of two-thirds of the members of the Board.

At the regular meetings of the Board, a majority as usual would decide all questions.

DISTRIBUTION OF PROFITS.

Six per cent. to the Shareholders,

Five per cent. Legal Reserve,.

Eight per cent. to the Board of Directors ;

The surplus to be divided between the shareholders and the Parts of Founder. The Board of Directors may make extraordinary reserves.

On the liquidation of the Company its assets are to be equally divided after the repayment of the shares, on the basis above named, that is to say, 60 per cent. to the shareholders, and 40 per cent. Parts of Founder.

In order to constitute the Company that is now in view, and to obtain the consent of Mr. Edison and the Light Company to the modifications which they will be asked to accept in the existing contracts, it will be necessary to constitute a syndicate composed of important financial houses, guaranteeing the subscription of the Capital.

The profit that the syndicate would receive, would be—(1) the profits on the sale of the shares subscribed. (2) One quarter of the profits coming to Mr. Edison and his assignees; (these parts of founder have a real and immediate value on account of the royalty on the lamp which goes to them.) And (3) in addition to the above, the syndicate will reserve to the subscribers to the first capital the right to subscribe a quarter of each future increase of capital of the Company.

By the figures which we have indicated, and by the possibility of the unlimited employment of capital which the Company will have, this right of subscription in all augmentations, gives a reasonable certainty of large profits, in as much as there will be no augmentation of capital except in proportion as the profits of the Company are real and sufficiently remunerative.

The right of subscription to a part of this first capital may be

conceded to important English, German, Austrian, Belgian, Dutch and Italian houses, who may demand it. The quotation of the shares of the Company will thus be assured on the principal Bourses of Europe.

MODE OF PLACING THE SHARES.

The syndicate will give the right of at least one quarter of the subscriptions to the actual shareholders of the three Edison Companies.

The syndicate may, if it shall seem desirable, offer the shares for public subscription ; but it may, with still greater advantage, sell on the different exchanges of Europe the shares after they are created. A premium on the shares is certainly to be expected if it is taken into account that the shares of the German Edison Company formed in the month of May last have been sold at a premium of nearly 20 per cent. This Company has the right only for Germany, a country where the average price of gas does not exceed 22 centimes per metre cube.

It is natural to suppose then, that the shares of a Company having a right of exploitation, and of creation of new companies everywhere in Europe, as well as of participating in the profits of companies already created, or to be created, will bear a still larger premium.

INTERNATIONAL COMPANY
EDISON

Articles of Association.

LONDON:

PRINTED BY CHAMBERS & SONS, WILSON STREET, FINSBURY.

INTERNATIONAL COMPANY EDISON.

Articles of Association.

Chapter I.

FORMATION AND OBJECT OF THE COMPANY. NAME, SEAT, DURATION.

Article 1.

There is formed by the present Articles, between the proprietors of the shares which are to be hereafter created a Joint Stock Company, under the conditions imposed by the French law of July 24th, 1867.

Article 2.

The Company has for its objects:—

(1.) The commercial and industrial exploitation by the direct employment of its own capital of all patents and certificates of addition, or of improvement taken in the different countries of Europe hereinafter named, for the inventions of Mr. Edison, for measuring, distributing, and applying electric currents for the

production of electric light and the transmission of motive power, as is provided in Article 6. This exploitation will be carried out,—

(*a*) By the manufacture of machines, lamps, and all the material and accessories necessary to the exploitation.

(*b*) By the installation of Central Stations, selling light to subscribers at a fixed price, and by measure.

(*c*) By isolated installations exploited by the Company itself.

(*d*) By the sale of isolated installations, lamps and material.

(2.) The Company may also, in accord with the Light Company, create sub-companies, sell the said patents, give licenses under them, in a word, do whatever shall be useful and necessary for giving value to the patents, but always under the conditions of these presents.

Article 3.

The Company will have the name of the International Edison Company.

Article 4.

The duration of the Company is fixed at 50 years from the date of its constitution. This duration may be prolonged by decision of the General Assembly, in the manner hereinafter prescribed.

Article 5.

The principal office of the Company is established at Paris, and branches may be established hereafter at such places as may be designated.

Chapter II.

PROPERTY.

Article 1.

The *Compagnie Continentale,* in the name of Mr. Edison and the Light Company, separately and conjointly, bring to the present Company, without any guarantee other than that of their existence, all the patents taken for the inventions of Mr. Edison, also for all objects or apparatus that may be utilized for the Electric Light, or for motive power, as well as all patents of improvement, and certificates of addition, but subject to the conditions of these presents and only in the following countries :—

(1.) France and the French colonies ;

(2.) Belgium ;

(3.) Denmark ;

(4.) The German Empire ;

(5.) Austria and Hungary ;

(6.) Russia ;

(7.) Italy ;

(8.) Spain ; the Spanish Colonies excepted.

The Attorneys of Mr. Edison and of the Light Company make an express reserve in favor of their principals, of the patents taken, or to be taken, the patents of improvement, or certificates of addition in the United Kingdom of Great Britain and Ireland, Portugal, Sweden and Norway, for the inventions which are above named.

In addition, the *Compagnie Continentale* and the Attorneys of Mr. Edison and the Light Company engage for the period, and under the conditions herein declared, to give to this Company all descriptions and all designs or models that may be necessary for the taking of patents for all inventions and all improvements

in all the countries of Europe not reserved above, in so far as these inventions and these improvements relate to the distribution of electric currents, and to the production and transmission of electric light, and of motive power as is stated in Article 2.

All the new patents, or patents of improvement, or certificates of addition, shall be taken in the name of Mr. EDISON, but by reason of the present engagement, the rights of property of the International Company in the said patents, patents of improvement and certificates of addition, shall be the same as those which the Company will possess in the existing patents.

All the expenses that shall be made for furnishing descriptions designs or models, shall be supported by the present Company, also all annuities and expenses made and paid for, the taking of new patents commencing with the date of registration of the Company.

All patents already taken and making part of the present engagement, shall be transmitted to the Company the day of its registration.

These patents will remain in the possession of the Company, but will always be held at the disposition of Mr. EDISON and the Light Company, who will have the right either to take copy directly or on their order, and without expenses at all times.

The Attorneys of Mr. EDISON and the Light Company engage the latter, whenever it shall be required, to give their aid for the accomplishment of the legal formalities necessary to assure to the Company the right of property in the said patents, patents of improvement and certificates of addition, taken, or that may be taken, and which make a part of the present engagement.

On the other side, the Attorneys of the Light Company engage that the Light Company shall not exploit, directly or indirectly, inventions of Mr. EDISON in so far as they have relation to the electric light and of motive power in any of the countries of Europe where the laws do not recognize the existence of patents.

It is well understood that the said patents, in all that concerns other objects than those here above enumerated, remain the exclusive property of Mr. EDISON and of the Light Company, and that the present Company will have the exclusive ownership of the said patents and inventions only as to the objects here above enumerated.

ARTICLE 2.

In case the laws of countries other than France should not permit the division of property in the patents and in the manner above provided, Mr. EDISON and the Light Company shall transfer to the International Company the exclusive right of the use of these patents for the objects named in the present engagements.

ARTICLE 3.

In all sales or transfers of patents or of rights attaching thereto, the rights above reserved to Mr. EDISON and the Light Company are expressly secured to them.

To this end Mr. EDISON and the Light Company shall make known at the principal office of the Company, their acceptance or refusal, either directly or by their Attorney at Paris duly accredited by them, and within 30 days from the notification of the project of contract which shall have been made by the present Company.

This notification shall be made by registered letter.

In case the International Company should desire, instead of exploiting directly itself, to make a total sale of one or of several patents for a part or for the whole of any one of the states, districts, or towns of Europe, or the concession of licenses for a part or the whole of one of these countries, districts, or towns, it shall not be valid without the consent expressly given in writing by Mr. EDISON and the Light Company.

Mr. Edison and the Light Company reserve in consequence the right to accept or to refuse all contracts involving such sale or concession of license which the Company shall propose to realize, and consequently without such acceptation no treaty shall be valid as has been above stated.

The Company whenever it shall make concessions of the said patents, or of any of them, to other Companies, shall stipulate, unless the laws of the countries where the said Companies shall be constituted are opposed, that a third at least of the Board of Directors in the said societies shall be named by the International Company, which engages itself with Mr. Edison and the Light Company to reserve to them the right of naming at least one director to make a part of the third of which the International Company will have the right to name.

In addition, the present Company shall reserve to itself the right of assuring that the purchasers or licensees of patents shall only use them to the extent of the concession made to the present Company.

Section 4.

Mr. Edison and the Light Company reserve to themselves the right of intervention with the International Company, or its assignees, in all suits against infringers of the said patents, and in all other legal processes relative to the said patents which the Society shall consider necessary to make, or which may be made against the said Company.

Section 5.

The Attorneys of Mr. Edison and the Light Company stipulate in favor of their principals, that on account of their situation as inventors and proprietors of the patents brought to the Society, the right entirely personal and non-transferable of placing a veto on any fusion with any other society, or taking over or

ceding the whole or any part of the property of the Company, or making any contract of participation with other societies.

This right however will terminate, and without possibility of recovery, from the day that Mr. Edison and the Light Company shall cease to be in their own name proprietors of at least a fifth part of the parts of founder attributed to them by Article 43 hereafter.

From the day that Mr. Edison and the Light Company shall cease to be proprietors in their own name of at least the said fifth part of the parts of founders attributed to them by Article 43 following hereafter, they will cease at the same time to have the right to the engagements made in their favor in paragraph 3 of the present Article.

In all the Sub-Companies constituted by the present Company, the majority at least of the shares shall be subscribed by the International Company itself, and these shares so subscribed by the Company shall not be sold without the consent of the Light Company.

A person named by Mr. Edison and the Light Company as their representative, may always assist at all the meetings of the Board of Administrators of the International Company, but only with deliberative voice, and he shall also have at all times access to the books of the Company, for the purpose of controlling the royalties and advantages stipulated in these engagements in favor of Mr. Edison and the Light Company.

The Attorneys of Mr. Edison and the Light Company have furnished at the moment of the foundation of the Company to the undersigned notaries, a statement of the French and Foreign Patents brought to the present Company by Mr. Edison and the Light Company, which statement made on a sheet of stamped paper of fr. 1.80, not yet registered, but which is to be registered at the same time as the present Articles of Association, remains annexed to this, after having been certified as a true copy by the said Attorney of Mr. Edison and the Light Company, and after the mention of its annexation has been made as above by the undersigned notaries at Paris.

As to the French Patents, the registration of the present engagements is to be made at the Prefecture of the Seine immediately after the registration of the Company, at the expense of the Company.

As to the Foreign Patents, the International Company charges itself immediately after its constitution, with the discharge of all the legal formalities necessary to secure the execution of the transfer made to the present Company by the Compagnie Continentale, Mr. Edison and the Light Company.

In consideration of their contributions and co-operation, there is attributed to Mr. Edison and the Light Company, first, a royalty of 25 centimes per lamp manufactured, employed or sold by the Company, or by its licensees, and a part of its profits as is set forth in Article 43 hereinafter.

Chapter III.

THE CAPITAL.

Article 7.

The Capital is fixed at thirty million francs, divided in 60,000 shares frs. 500 each.

These   shares are to be subscribed and one half paid up at subscription, and the present Company shall only be considered as definitely constituted after the subscription of the total number, and the payment as above provided of fifty per cent. of each subscription.

Article 8.

The Capital of the Company may be augmented from time to time by decision of a General Meeting of the Shareholders on the proposition of the Board of Directors.

The Board of Directors will fix the conditions of the new emissions.

The preference for subscription of the new shares is reserved as follows:—

One quarter to the subscribers, or to their assigns, of the shares which constitute the first Capital of the Company in proportion to each subscription.

One quarter to the Board of Directors in office at the time of the augmentation of the Capital, in order to allow it to provide for the interests of the service.

[The Board of Directors will decide as to the manner of placing this quarter;]

And one half to the proprietors of the shares constituting the social capital at the epoch of each augmentation, in the proportion to the number of shares possessed by each one of them.

Persons who are not possessors of an entire share may write to exercise their right in the conditions that will be determined by the Board of Directors.

Article 43.

The net product, deduction being made of expenses, constitutes the profits.

From these profits there is to be taken:—

5 per cent. for the constitution of the fund of legal reserve.

The net profits, the foregoing deduction being first made, shall be distributed as follows:—

6 per cent. to the Shareholders as a dividend;

8 per cent. to the Council of Administration;

40 per cent. to the Light Company and to Mr. Edison in representation of their contributions to the objects of the Company, subject to arrangement between themselves;

The remainder for a supplementary dividend to the Shareholders.

These proportions shall be invariable, whatever may be the augmentation of the Capital of the Company.

Article 44.

The part in the profits attributed to the Light Company and to Mr. Edison by the preceding article, shall be represented by shares entitled certificates of parts of founder, of which the Light Company and Mr. Edison will dispose according to their pleasure.

The royalty on lamps provided for by Section 5, Article 6, as above, shall be distributed *pro ratâ* to the holders of the said parts of founder, semi-annually.

A decision of the Council of Administration taken in accord with the founders, will fix ultimately the number and the form of these shares, which will not give to their proprietors the right of assisting in the general assemblies.

These shares shall be to order or to bearer at the choice of their proprietors.

They will confer no other rights than those of which mention has been made above, and give rise to no obligation.

They will be transmitted by simple delivery if they are to bearer, and by transfer if they are to order.

The royalties and profits belonging to these parts of founder will be paid to the bearer of the share.

Compagnie Continentale Edison

This folder contains printed material issued by the Compagnie Continentale Edison. Organized in Paris on February 17, 1882, this company controlled Edison electric light patents in Austria, Belgium, Denmark, France, Germany, Hungary, Italy, Russia, and Spain.

The following items have been filmed:

1. "Premier Bulletin" (1882)
2. "Second Bulletin" (1882)
3. "Eclairage par Stations Centrales" [Bulletin No. 3] (1883)
4. "Eclairage par Stations Centrales" [Bulletin No. 5] (1883)

The following item has not been filmed:

"Statuts" (1882) [An annotated copy can be found in the Charles Batchelor Collection (Special Collections Series); an English translation can be found in D-82-038 (Document File Series).]

N° 1. Paris, 24 juin 1882

PREMIER BULLETIN

—

Compagnie Continentale Édison

27, CHAUSSÉE D'ANTIN, PARIS

(Nous commençons aujourd'hui la publication de ce Bulletin destiné à relater tous les progrès réalisés dans les installations centrales ou isolées de « l'*Éclairage électrique Édison* ».

En faisant cette publication notre intention est de tenir nos correspondants au courant des découvertes et des applications nouvelles introduites dans l'usage de la lumière électrique soit aux États-Unis, soit en Europe.

Nous publions dans ce premier numéro un article très intéressant sur l'installation centrale, actuellement en cours d'exécution à New-York, destinée à l'éclairage de tout un quartier et qui alimente vingt mille lampes Edison de deux carcels chacune.

Nous donnons aussi quelques renseignements sur une station centrale moins considérable établie à Fall-River, dans l'État de Massachusetts, sur celle de Cristal à Londres et sur quelques autres installations isolées disséminées sur le territoire des États-Unis.

Dans un prochain numéro nous publierons un article spécial sur les installations établies depuis plusieurs mois en Europe et sur notre usine d'Ivry-sur-Seine).

Première station de New-York

Paris, Juin 1882.

La première installation pour l'éclairage d'un quartier de New-York par la lumière Edison est sur le point

d'être complètement terminée. Ce quartier a près de 300 hectares de superficie.

La Compagnie a fait l'acquisition des immeubles situés nos 255 et 257 Pearl street, un peu au sud de Fulton street pour y installer l'usine centrale de production des courants électriques qui doivent circuler dans tout le quartier au moyen de conducteurs souterrains.

Les travaux d'installation ont été extrêmement considérables. On peut les diviser en quatre parties, savoir : la mise en état des bâtiments pour l'établissement des machines et des divers services, la fabrication et le montage des moteurs machines-dynamos et autres appareils électriques, la fabrication et la pose des conducteurs souterrains, enfin la pose des fils dans les maisons. La première partie comprend la confection des fondations en maçonnerie, des ouvrages en béton, la pose d'une carcasse en fer à deux étages, le percement des voûtes sous les trottoirs et les rues, le montage de quatre chaudières capables de produire 1000 chevaux-vapeur, l'établissement des tuyauteries correspondantes, de deux cheminés (de 1m,50 de diamètre, sur 24 mètres de haut), de monte-charges à vapeur pour le charbon et les cendres, de transmissions de pompes et de soufflerie. Tous ces travaux que nous venons d'énumérer sont complètement terminés, il ne reste plus qu'à installer les appareils de ventilation et des ascenceurs à vapeur. L'installation se composera de six moteurs, de six dynamos, et de régulateurs.

Les moteurs sortent des ateliers de construction

de la Southwark Foundry et Machine Company de Philadelphie. Chacun a une puissance normale de 125 chevaux-vapeur, puissance qui peut être portée à 200. On dispose donc d'une force totale maxima de 1200 chevaux. Les six dynamos sont en construction dans les Edison Machine Works, Goerck street, New-York City, et sont presque achevées. Les appareils de réglage vont être également terminés.

Chacune de ces six dynamos à vapeur pèse 30 tonnes, soit un poids total de 180 tonnes. Le poids de toute la construction et des appareils électriques du seul 257 Pearl street sera d'environ 250 tonnes, et se trouvera répartie de manière à ne donner qu'une pression moyenne de 1000 kilos par mètre carré.

En ce qui concerne les conducteurs souterrains, les travaux sont poussés aussi rapidement que possible. Avant le 1er mars 1882 on avait posé 3500 mètres de conducteurs principaux, et dans le seul mois de mars on en a posé 5000. Ce mois avait 27 jours de travail et quatre dimanches, mais la pluie fit perdre 5 jours et des causes diverses en firent perdre 2, de sorte que l'on n'a travaillé effectivement que pendant 20 jours et une nuit. La moyenne par jour de ce mois était de 190 mètres, la moyenne par journée de travail effectif, de 260 mètres; le minimum que l'on ait fait en un jour est de 140 mètres et le maximum de 315 mètres.

Il reste encore à poser plus de 5000 mètres de conducteurs principaux, puis les traversées et les raccords dans les croisements de rue. Ceux-ci, par parenthèse, prendront plus de temps de pose par mètre courant que les conducteurs eux-mêmes.

L'établissement des fils dans les maisons est terminé depuis le commencement de février.

Nous avons complètement emménagé ainsi 107 locaux dans Beekman st.; 166 dans Fulton st.; 75 dans John st.; 78 dans Maiden Lane; 97 dans William st.; 46 dans Frout st.; 68 dans Nassau st.; 43 dans Pearl st.; 36 dans Cedar st.; 28 dans Pine st.; 24 dans South st.; 31 dans Ann st.; 12 dans Spruce st.; et quelques-uns dans d'autres rues de manière à faire un total de 946 locaux prêts à fonctionner.

Le nombre de lampes prévu est de 7916 A (16 bougies) et 6395 B (8 bougies) soit en tout 14 311 lampes.

Les lampes elles-mêmes sont finies depuis des mois, emmagasinées et toutes prêtes à fonctionner.

La station centrale fournira de l'électricité non seulement pour ces lampes et d'autres encore, mais aussi pour faire fonctionner des ascenseurs, des monte-charges, des presses d'imprimerie et des machines de toute sorte.

Il ressort clairement de tout ce qui précède qu'il reste très peu de chose à faire, en dehors de la pose des câbles souterrains, pour que le premier quartier de New-York soit complètement terminé, et que l'éclairage électrique y commence.

Installations à Chicago.

Nous sommes en train de monter une installation isolée à Palmer House pour éclairer la salle à manger.

L'installation dans les magasins de Rand, M. Nally et C^ie^ est vivement appréciée. Les propriétaires disent que s'ils faisaient enlever nos lampes pour les remplacer par le gaz, les ouvriers les leur redemanderaient.

Ils trouvent notre lumière très commode pour mélanger des encres colorées, opération impossible à réussir même en plein jour.

M. John V. Farewell a commandé deux installations isolées pour les bâtiments d'assurance : Republic Insurance Buildings.

Station centrale en miniature à Fall-River.

Une de nos petites installations montée à Fall-River est en train d'éclairer plusieurs magasins, un bureau télégraphique et les salles d'un club, tous ces locaux sont répartis dans deux pâtés de maisons différents. Ce sont les magasins de bijouterie de M. *Bruneau*; ceux de denrées sèches de M. *Sargent*; ceux du tailleur *Boone*; puis la quincaillerie de MM. *Trafton et Anthony*; les magasins de confection de L. D. *Wilbur et C°*; le bureau

télégraphique de la *Western Union;* deux entrées de l'*Académie de Musique*, enfin les corridors et salles du *Commercial Club*. Il y a en tout 120 lampes *A* et 6 *B*, et les dynamos sont à environ 130 mètres des lampes.

M. Spencer dans une communication datée de Fall-River le 4 Avril, s'exprime dans les termes suivants au sujet de cette installation.

« Hier soir nous avons achevé les premières 150 heures de marche de notre petite station de Fall-River. Tous ceux qui se servent de cet éclairage en font le plus grand éloge et le placent bien au-dessus du gaz. M. Boone dit qu'il est exempt de tous les inconvénients du gaz et qu'il donne trois fois plus de lumière. La plupart des magasins restent ouverts jusqu'à dix heures du soir. L. D. Wilbur et Cᵒ chez qui 30 becs de gaz ont été remplacés par 27 de nos lampes, m'ont raconté que le gaz rendait le séjour de leur boutique intolérable bien avant l'heure de fermeture, tant à cause de la chaleur que du mauvais air. Ils ne comprennent pas comment ils ont pu endurer le gaz si longtemps et ne veulent se défaire pour rien au monde de la lumière électrique. Le témoignage des autres consommateurs est uniformément le même. Dans les salles du club on admire beaucoup l'éclairage surtout dans les cabinets de lecture. Je n'ai pas besoin de vous dire à vous qui connaissez les frais d'entretien d'une station combien cette lumière est économique; je vous parlerai seulement de la durée des lampes que nous avons eu occacasion de vérifier. Pour une installation de 120 lampes au lieu de 127 que nous avons ici, la moyenne de 600 heures que vous garantissez pour les

lampes, permettrait d'en remplacer 30 toutes les 150 heures, pourvu qu'on ne dépasse pas l'intensité lumineuse normale de 16 bougies. Pourtant nous la dépassons ici et nos lampes ont un pouvoir de 20 à 25 bougies. Malgré cela nous n'avons cassé que sept lampes, dont deux dans le même appareil fixé au cadre de la porte du magasin Sargent, et je soupçonne le choc de la porte de ne pas être étranger à cet accident. En admettant même que ces lampes aient été mises hors d'usage par le courant, notre moyenne est encore très basse.

Les appareils fonctionnent dans la perfection, les dynamos sont parfaitement équilibrées, et entièrement exemptes d'étincelles au commutateur. On a mesuré le travail du moteur et on a trouvé 17,1 chevaux-vapeur soit 7,3 lampes par cheval compté dans le cylindre. Si l'on considère que tous les frottements du moteur et des machines y sont compris, on peut affirmer sans crainte que les dynamos alimentent très bien 8 lampes de 20 bougies, par cheval compté sur la courroie. Notre installation a été visitée et inspectée par beaucoup de manufacturiers de Fall-River et par de nombreux visiteurs d'autres localités. Tout le monde en a fait le plus grand éloge. Elle est confiée aux soins d'un jeune Américain intelligent, d'une vingtaine d'années qui n'a aucune peine à la conserver en bon état et à la faire fonctionner parfaitement.

Cette petite installation fait merveille auprès de ceux qui l'ont vue pour attirer des partisans à la lumière Edison ».

Chemin de fer électrique d'Edison.

Vendredi dernier, le professeur G. F. Barker de Philadelphie et le professeur H. Draper de New-York, ont visité Menlo-Park en compagnie de M. Edison, pour voyager sur le chemin de fer électrique. L'excursion a été très satisfaisante. En ce moment la ligne n'est installée que pour le transport des passagers, mais une machine et des wagons de marchandises sont actuellement en construction. Il s'agit de trouver expérimentalement le prix de revient d'un transport électrique des marchandises.

Appareils de sûreté Edison contre l'incendie.

L'*Electrician* de Londres contient de nombreuses illustrations des conducteurs fusibles de M. Edison et les décrit en ces termes :

« Une partie importante du système de M. Edison est celle qui sauvegarde contre l'incendie. On conçoit facilement qu'il puisse arriver que, pour des causes imprévues, les conducteurs soient parcourus par un courant plus fort que celui auquel ils étaient destinés. Un pareil courant échaufferait les câbles et pourrait causer d'assez grands dommages. Pour se mettre en

garde contre une pareille éventualité, M. Edison, intercale dans ses circuits une jonction métallique fusible, qui fond dès que le courant atteint une intensité donnée. »

Installation à Stillwater, Minn.

M. Roney, le directeur de la partie de l'usine de Seymour Sabin et Cᵒ à Stillwater, où nous avons monté une de nos installations isolées, nous dit dans une lettre récente que « les dynamos marchent admirablement jour et nuit. Nous nous servons encore des mêmes balais qu'au début et ils ont l'air tout neufs. »

Cette installation se compose de deux dynamos Z alimentant 280 lampes B, dont 30 se trouvent dans la demeure de M. Sabin à 350 mètres de l'usine. Les dynamos ont commencé à fonctionner le 24 décembre.

L'Exposition du palais de Cristal.

Il y a 854 lampes au Palais de Cristal.

Elles sont réparties de la manière suivante : salle de concert 380 lampes, salle des représentations 200 lampes, boutiques 84, nef centrale 48, entrée de

la gare 47, domestic company 80, chambre des machines 15. Ces lampes sont alimentées par douze petites dynamos placées à l'étage au-dessous et disposées de tell sorte que l'une quelconque peut être retirée du circuit sans affecter en rien la lumière. Le courant est porté des machines aux lampes par un seule câble. Chaque circuit est muni d'un commutateur permettant de faire circuler le courant ou de le supprimer à volonté, et chaque ramification est munie d'un coupe-circuit, appareil de protection, destiné à ouvrir automatiquement le circuit en cas d'accident. Aucun accident d'aucune espèce ne s'est d'ailleurs jamais produit.

La salle de concert (éclairée au moyen de 380 lampes) est journellement le théâtre de divertissements variés et souvent elle est bondée. Bien qu'elle soit très grande et difficile à éclairer, tout le monde y trouve notre lumière parfaite. — Dernièrement, à une conférence avec expériences, faite dans cette salle, près de la moitié des lampes furent éteintes et rallumées à un signal du conférencier sans affecter en rien les lumières restantes.

La lumière Edison est la seule qui ne se soit jamais éteinte depuis le commencement de l'exposition, et n'ait ainsi plongé les visiteurs dans l'obscurité.

L'exposition Edison a été visitée par le duc d'Edimbourg et sa suite, deux fois par le duc de Westminster, deux fois par le duc de Sutherland, puis par le président et le Conseil d'administration de la C^ie du Midland Railway, par le collège du gaz (300 membres) et par d'innombrables délégations de villes et de villages. M. Johnson a aussi dû prendre l'engagement de

donner des expositions privées du système Edison à la *Société des Arts*, à la *Royal Society*, et dans beaucoup d'autres corps importants.

L'*Engineering* de Londres contient dans son numéro du 17 mars un long compte rendu illustré de l'exposition Edison au Palais de Cristal. Il s'exprime ainsi :

« De tous les systèmes d'éclairage électrique, représentés au Palais de Cristal, l'installation la plus complète et la plus importante est celle de M. Edison, ou plutôt de la *Edison Electric Light Company*. Toute l'exposition de cette compagnie entreprenante est caratérisée par la perfection des détails et par son côté vraiment pratique. On peut s'en rendre compte aussi bien par le remarquable éclairage des salle de représentations et de concerts que par la splendide installation des machines électriques et des moteurs à l'entrée des jardins. Il est universellement rendu justice à cette exposition tant par les personnes compétentes que par les amateurs plus impartiaux. Grâce à son admirable simplicité, à l'ingéniosité des connexions et à la manière de régulariser le courant, l'installation Edison peut être considérée comme l'installation mécanique la mieux comprise et la plus parfaitement exécutée de l'exposition.

6417. — Imprimerie A. Lahure, rue de Fleurus, 9, à Paris.

N° 2. Paris, 10 octobre 1882.

SECOND BULLETIN

Compagnie Continentale Edison

27, RUE DE LA CHAUSSÉE-D'ANTIN (1)

(Le présent Bulletin a pour but de faire connaitre à nos correspondants les progrès accomplis par notre système d'éclairage depuis la création des Sociétés EDISON pour le continent européen (17 février A. C.).

Nous sommes obligés, afin de ne pas dépasser les étroites limites que comporte cette notice, de nous borner à ne mentionner que quelques-unes de nos plus intéressantes applications.

Tout d'abord nous ne croyons pouvoir mieux faire que de reproduire en tête de ce Bulletin le bienveillant article que le *Journal des Débats*, du 20 août dernier, a consacré à notre usine d'Ivry; car ce n'est que grâce à l'activité et à la haute compétence de M. Batchelor, l'ingénieur en chef de nos Sociétés, que nous devons d'être en mesure, après un aussi court espace de temps, de pouvoir donner satisfaction à toutes les commandes qui nous sont adressées de toutes les parties de la France.

Si, dans ce Bulletin, nos applications en France ne tiennent pas une plus grande place, cela provient de ce que la loi qui

(1) *S'adresser pour les commandes et renseignements,* 33, *avenue de l'Opéra.*

régit les brevets français ne permet pas d'introduire en France le matériel fabriqué à l'étranger; nous ne pouvions, ici, nous servir du matériel provenant de l'usine Edison, à Menlo-Parc (New-Jersey) comme nous l'avons fait dans les autres pays de l'Europe. Depuis la constitution de nos Sociétés nous avons installé, pour ne citer que les machines dynamo-électriques commandées à New-York :

4	type	C	de	1200	lampes A
16	—	K	de	250	—
6	—	L	de	150	—
71	—	Z	de	60	—
30	—	E	de	17	—

Usine Edison, à Ivry-sur-Seine.

Le plus bel établissement électrique qui existe actuellement en France tant au point de vue de la grandeur du bâtiment qu'au point de vue de la perfection de l'outillage est celui que vient d'installer à Ivry, près de Paris, la Compagnie de la lumière Edison. En outre de la façade principale de cet établissement qui forme une grande cour d'honneur bâtie de tous les côtés, il y a un grand nombre de corps de bâtiments à quatre étages placés parallèlement et perpendiculairement tout autour et qui donnent à l'ensemble l'aspect d'une véritable cité ouvrière admirablement installée.

C'est dans les diverses parties de ces bâtiments que sont établies les machines destinées à la fabrication économique des divers engins qui entrent dans le système d'éclairage électrique Édison.

Dans l'un de ces bâtiments se trouvent les tours et outils d'ajustage nécessaires pour la construction des machines dynamo-électriques. On en construit de plusieurs modèles qui peuvent fournir individuellement l'éclairage de 17, 60, 100, 125, 150, 250, 500 et 1,200 lampes.

Dans plusieurs autres bâtiments sont les ateliers affectés à la fabrication des lampes. On y voit les petites lamelles de bambou, qui arrivent du Japon par bottes, passer par diverses mains pour se trouver réduites successivement à l'épaisseur voulue qui est celle d'une feuille de papier et être, en fin de compte, découpées de manière à présenter la grosseur d'un filament délié, parfaitement calibré et terminé à ses deux bouts par une sorte d'évasement au moyen duquel on le fixe aux fils du circuit.

Ailleurs, on procède à la carbonisation des filaments. On commence par les mettre dans de petits moules plats et hermétiquement fermés en les recourbant en fer à cheval, puis on place les moules dans des caisses en graphite bien

closes que l'on met à leur tour dans des fours chauffés à une haute température. La fabrication des ampoules de verre de ces sortes de lampes s'effectue dans deux ateliers différents. Dans l'un, on construit les tubes de verre à travers lesquels sont soudés les fils de platine auxquels doivent être attachées les extrémités des filaments de charbon ; dans l'autre, on fabrique les ampoules au sein desquelles les tubes précédents doivent être introduits avec leur charbon, et qui doivent être soumises à l'action du vide.

C'est une chose curieuse de voir la promptitude avec laquelle ces diverses opérations sont effectuées. On peut fabriquer jusqu'à 500 lampes par jour. Mais ce qui excite surtout la curiosité, c'est la manière dont le vide est fait dans ces lampes ; il y a toute une installation de cabinet de physique. Qu'on imagine, dans une vaste salle, une sorte d'enceinte allongée, fermée par trois cloisons de 2 mètres environ de hauteur et sur les parois desquelles sont installés extérieurement par séries 500 tubes barométriques à mercure ; qu'on imagine adaptée à chacun de ces tubes une lampe avec son ampoule non encore fermée et, au milieu de l'espace confiné par les cloisons, deux grands tubes de fonte d'environ 20 centimètres de diamètre communiquant avec les 500 tubes et mis en rapport avec une énorme machine à vide de Sprengel, et on pourra se faire une idée de l'importance qui a été donnée à cette fabrication.

L'opération du vide dans les lampes est extrêmement importante et très délicate, car non seulement le vide doit empêcher la combustion du filament de charbon, mais il doit encore augmenter la ténacité du filament lui-même. C'est pourquoi on doit procéder à plusieurs opérations successives effectuées après des intervalles de temps plus ou moins longs pendant lesquels on rend le filament incandescent sous l'influence d'un courant plus ou moins énergique. De cette manière, les gaz renfermés dans les pores du charbon se

dégagent, la densité de celui-ci augmente, et la ténacité devient assez grande pour être comparable à celle d'un fil métallique. Dans ces conditions, des filaments de charbon gros comme un cheveu peuvent résister à de fortes secousses communiquées à la lampe, dont la durée n'est pas inférieure à huit cents heures.

Paris.

GARE SAINT-LAZARE

La première installation publique de la Lumière Edison, à Paris, a été inaugurée, le 9 septembre, à la gare Saint-Lazare et fonctionne, depuis ce jour, de la façon la plus parfaite.

Cette installation comporte deux parties distinctes : premièrement les rotondes de Saint-Germain et des lignes de Normandie, éclairée par 50 lampes A, et secondement les quais de la grande vitesse situés à l'intérieur de la gare, près de la rue d'Amsterdam, et éclairés par 55 lampes A.

Dans la rotonde, les lampes sont placées sur des lustres à trois branches, d'un modèle simple et élégant ; il y a également deux appliques à une lampe, fixées au mur et 9 lustres à une seule lampe ; chaque lampe éclaire une superficie de dix-sept mètres carrés.

Sur les quais de la grande vitesse les lampes sont fixées sur des lustres très simples, d'une seule lampe chacun. La superficie éclairée par chaque lampe est ici de cinquante-sept mètres carrés.

Deux machines dynamo Z, placées près de la rue de Rome et actionnées par un moteur à vapeur, fournissent le courant électrique aux deux parties de l'installation ; le hangar où elles sont placées se trouve à 275 mètres environ de la rotonde de Saint-Germain et à 350 mètres environ des quais

de grande vitesse; malgré ces distances considérables, la perte de force électro-motrice est insensible, grâce à la perfection du système.

Le public et le personnel de la gare admirent la fixité et la douceur de la lumière, et de toutes parts nous avons entendu proclamer la supériorité absolue de l'installation Edison sur toutes celles qui ont été faites jusqu'ici à Paris avec d'autres systèmes d'éclairage électrique.

Poudrerie nationale de St-Chamas

MINISTÈRE DE LA GUERRE

La Poudrerie nationale de St-Chamas (Bouches-du-Rhône), est brillamment éclairée depuis le 15 septembre par le système Edison.

Cette installation demandait un mode d'éclairage produisant la plus grande quantité de lumière et le moins de chaleur possible.

Une lampe Edison A éclaire chaque usine, et est placée dans un jour pratiqué dans le mur; l'ouverture est taillée en biseau de façon à ce que les rayons de lumière puissent pénétrer dans toute la salle, dont la superficie est de 64 mètres carrés, et éclairer les diverses parties des machines; une simple vitre est scellée à cette ouverture et sépare la lampe du moulin à poudre; le commutateur pour éteindre ou allumer chaque lampe est placé sur le mur à l'extérieur de l'usine.

L'effet produit forme un contraste des plus satisfaisants avec l'ancien éclairage à l'huile.

Il y a 24 usines à poudre, comprenant 24 lampes A, 14 lampes sont placées au centre des voûtes en maçonnerie supportant le canal, 20 lampes sont placées dans les chemins de communication de la Poudrerie dans des réverbères,

2 dans le cabinet du Directeur, 2 dans les bureaux, et enfin 2 au-dessus de la porte d'entrée; au total 64 lampes A.

La machine dynamo est actionnée à la vitesse de 1,200 tours par minute par un système de transmissions mû au moyen d'une roue à eau de 9 mètres de diamètre faisant cinq tours à la minute, installée sur un canal provenant de la rivière (Touloubre).

La Poudrerie est éclairée pendant 12 heures chaque nuit. Le Directeur, l'Ingénieur en chef et tout le personnel comprenant 300 ouvriers, sont très satisfaits de la Lumière Edison, qui donne à l'éclairage de la Poudrerie une sécurité inconnue jusqu'ici.

Besançon.

Deux installations comprenant ensemble 110 lampes, fonctionnent à Besançon depuis le 9 septembre et éclairent le tunnel de la Citadelle (long de 420 mètres et large de 12), le café Granvelle, et les magasins de bronzes et objets d'art de la maison Dubois Chevaidel.

Les deux installations sont actionnées par une force hydraulique empruntée au moulin de Taragnoz, situé en dehors des fortifications à 95 mètres du tunnel et à 600 mètres environ de la maison Dubois Chevaidel.

Les conducteurs principaux traversent le Doubs d'un seul jet et sont fixés dans les rues sur des poteaux télégraphiques placés en bordure des trottoirs de 25 mètres en 25 mètres.

Dans le tunnel, les lampes sont supportées par des tiges de fer scellées dans la voûte; la ligne des lampes est à 3 m. 60 du niveau du chemin de halage.

Les résultats sont des plus brillants; le public Byzontin qui assistait à l'inauguration et comprenait toutes les notabilités de la ville, a marqué son approbation par des applaudissements prolongés.

Les principaux journaux de la région, tels que : l'*Union Franc-Comtoise, la Démocratie, le Courrier, le Démocrate*, etc., etc., ont constaté le succès complet du système Edison.

Les ouvriers de l'industrie horlogère, et le commerce, demandent avec instance l'installation générale du système, pour l'éclairage de la ville et des ateliers.

Bordeaux.

L'éclairage Edison fonctionne depuis le 15 août à l'Exposition de la Société Philomatique de Bordeaux ; deux machines dynamo Z sont installées dans une annexe.

Une partie de cette annexe a été meublée de la façon la plus artistique par les principales maisons d'ameublement de Bordeaux ; le centre de la travée forme salon, un des côtés chambre à coucher, et l'autre côté salle à manger ; le tout est éclairé brillamment par 120 lampes Edison placées sur des lustres, des appliques, des torchères et des supports mobiles.

L'effet produit par les lampes incandescentes Edison fixées sur les lustres en cristal est des plus heureux et des plus agréables à l'œil.

L'annexe où fonctionne notre éclairage constitue une des principales attractions de l'Exposition de Bordeaux ; de l'avis des visiteurs, jamais éclairage n'a réuni des conditions aussi complètes de fixité, de régularité et d'élégance.

Dijon.

Une installation de 65 lampes A a été inaugurée le 9 août à Dijon, dans un local disposé pour une Exposition d'objets d'art pour ameublement, tels que bronzes, étoffes, etc..., et comprenant plusieurs pièces.

Un grand salon est éclairé par 8 lustres de 2 lampes chacun et 4 appliques de 1 lampe.

Des vitrines renfermant les objets exposés et imitant la disposition d'une devanture de magasin, sont éclairées par 16 lampes placées en rampe.

Une grande salle à manger où est dressée une table de 40 couverts est éclairée par 3 lustres de 3 lampes chacun et 8 appliques de 1 lampe, la chambre des machines est éclairée par 5 lampes.

L'effet produit est des plus heureux et tous les visiteurs en sont enchantés.

Le Conseil Municipal de Dijon, qui assistait en corps à une soirée qui lui avait été exclusivement réservée, s'est montré si satisfait, qu'il a autorisé la pose des câbles dans les rues de la ville, pour l'établissement des stations centrales.

Perpignan.

La nouvelle et importante usine de MM. Joseph Bardou et fils, fabricants de papiers à cigarettes, est éclairée depuis le 20 septembre par le système Edison ; la machine dynamo Z est actionnée par le même moteur à vapeur qui fournit la force à toute l'usine.

MM. Joseph Bardou et fils nous écrivent comme suit à ce sujet :

« Nous avons 58 lampes A qui éclairent d'une façon
« admirable nos ateliers, salle de machines, salle de chau-
« dières, machines à couper le papier, laminoirs, ascenseur,
« machines et presses lithographiques, ateliers de ma-
« nipulation du papier à cigarettes, cartonnages, ateliers de
« forge et ajustage, nos bureaux, en un mot toute notre
« usine.

« Tous nos ouvriers sont enchantés de cet éclairage qui
« leur permet de rapprocher les lampes de leur travail, sans

« avoir l'extrême chaleur que leur procuraient les becs de « gaz, la lumière est douce, d'une fixité invariable, et nous « considérons cet éclairage comme le plus remarquable dans « des ateliers où travaillent 90 et 100 personnes réunies, « parce qu'il n'absorde pas comme le gaz l'oxygène de l'air « et ne dégage absolument aucun gaz délétère, tels qu'oxyde « de carbone, sulfureux ou carbonique.

« Nous avons en outre l'avantage, quand nos machines « lithographiques tirent certaines couleurs jaune d'or et « autres qui ne se voient pas au gaz, de pouvoir corriger « notre travail et régler l'encrage. Enfin nous sommes « entièrement satisfaits de notre innovation, et nous vous en « adressons nos meilleures félicitations. »

Allemagne

Berlin. — Une installation dans le Böhmisches Brauhaus (brasserie bohémienne) a donné des résultats superbes. L'installation, que nous avions placé d'abord à titre d'essai est maintenant définitive, et tout le monde, le patron aussi bien que les ouvriers, est enchanté de notre lumière.

Voici la lettre que nous avons reçue à ce sujet :

« Nous pouvons vous faire part des remarques suivantes faites sur les essais d'éclairage à l'aide du système Edison.

Nous avons employé la lumière électrique dans les aires de Malt, dans les caves de fermentation et dans le dépôt où nous nous sommes servis auparavant du gaz et de bougies de Stéarine; du gaz dans les corridors seulement, parce que le gaz chaufferait trop dans les caves de fermentation et de dépôt.

Dans les chambres de Malt par exemple, la plus petite quantité de gaz influe d'une manière tout à fait nuisible sur

le développement du Malt, et ceci abstraction faite de l'échauffement et du dessèchement de l'air produits par les flammes de gaz.

Tous ces ennuis sont absolument supprimés par l'emploi de la lumière électrique.

Le développement de la chaleur est si petit que l'on ne peut pas constater d'élévation de température au thermomètre.

Dans la Malterie il ne faut que peu de lampes pour éclairer de grands espaces, elles n'ont même pas besoin de brûler à pleine intensité parce que les plafonds recouverts de blanc renvoient les rayons de lumière.

La lumière électrique se montre tout à fait avantageuse dans les caves de fermentation et de dépôt.

En dehors de l'installation dans la Malterie nous employons des lampes fines et mobiles qui nous permettent d'accomplir des travaux tels que le lavage des cuves, le transvasement des grands tonneaux dans les fûts.

Nous n'avons pas encore pu faire de calcul au point de vue de l'économie ; cependant nous ne doutons nullement que cette lumière, grâce à son peu de chaleur et à sa sécurité par rapport à l'incendie, ne remplace sous peu la lumière employée jusqu'ici dans les brasseries, c'est-à-dire le gaz et la lumière si coûteuse des bougies. »

Berlin, le 6 août 1882.

Une installation a été faite à Berlin également dans l'imprimerie de M. Buxenstein. Elle fonctionne parfaitement et le propriétaire a adressé à notre représentant une lettre dont nous extrayons le passage suivant :

« L'éclairage fonctionne depuis le 12 avril. Tous les avantages que vous m'avez promis précédemment sur ce système se sont parfaitement réalisés. »

Les deux cercles « Ressource » et « Union Club » ont adopté notre lumière qui fonctionne déjà depuis quelque temps dans la Ressource, à l'entière satisfaction de ses membres. A l'Union Club on a trouvé notre lumière si belle qu'on remplace en ce moment la première installation de 60 lampes par une autre de 150 lampes, qui sera inaugurée à l'occasion d'une grande fête à laquelle l'Empereur a promis d'assister.

Munich, Exposition. — L'Exposition électrique au Palais de Cristal de Munich a été ouverte le 16 septembre et notre société a remporté un véritable triomphe. Nous avons éclairé le théâtre de l'Exposition, la bibliothèque, la salle de lecture, le restaurant, le buffet et deux rues avec plus de 800 lampes actionnées par 3 machines K, 2 machines Z et 2 machines E. Une salle, réservée spécialement pour nous, contient des modèles de tubes, de conducteurs, le plan de l'éclairage du quartier de New-York, le phonographe et autres inventions de M. Edison. Nous reviendrons sur cette Exposition dans un de nos prochains bulletins et nous nous contentons pour aujourd'hui de reproduire l'extrait suivant d'un article paru dans le *Tagblatt* de Berlin du 18 septembre.

« Nous entrons maintenant au théâtre, éclairé par le système Edison. C'est jusqu'à présent la *great attraction* de l'Exposition. La stabilité de la lumière et sa couleur douce produisent un charmant effet, et font paraître les visages et les costumes beaucoup plus frais par l'éclairage. Il faut ajouter à ces avantages l'absence de tout danger et de la chaleur. »

Cuirassé Chinois. — Le gouvernement chinois, qui fait construire en ce moment à Stettin un cuirassé, a suivi l'exemple donné par les Américains et les Russes en adoptant des lampes Edison pour éclairer ce bâtiment. On voit

que Messieurs les Chinois aiment le progrès et devancent même quelquefois des nations civilisées.

Dresde. — La grande manufacture de pianos de M. Ascherberg sera entièrement éclairée par notre lumière. Un dynamo K (250 lampes A), ainsi que les lampes, douilles et autres accessoires sont déjà sur place, et notre usine d'Ivry-sur-Seine termine en ce moment les lustres, les suspensions, les appliques, etc.

Ahlen. — Une mine de strontianite va être éclairée par nos lampes. C'est la première fois qu'on se servira de l'électricité pour éclairer une mine; cet essai sera donc du plus grand intérêt. Le matériel nécessaire (une installation de 60 lampes A) vient d'être expédié, et nous nous proposons de publier un rapport très détaillé sur ces expériences.

Poesneck. — Une installation de 60 lampes A éclaire une partie de la grande manufacture de MM. Fischer et Seige, qui sont enchantés de la belle lumière et qui ont fait les plus grands éloges à notre représentant.

Sarreguemines. — Dans les grandes et importantes faïenceries de M. Utzschneider fonctionne, depuis plusieurs mois, une installation de 60 lampes A. Les résultats ont été tellement satisfaisants et concluants que nous sommes en ce moment en pourparlers pour la formation d'une station centrale à Sarreguemines.

Strassburg. Gare. — Une installation de 60 lampes fonctionne à la gare de Strasbourg depuis le commencement du mois de janvier. La durée moyenne de toutes les lampes est de mille heures, mais il y en a quelques-unes qui ont atteint, dans ce moment, une durée de plus de deux mille heures.

Le résultat était tellement satisfaisant que la direction des chemins de fer de l'empire allemand nous a invité à lui soumettre un devis pour l'éclairage de la nouvelle station cen-

·trale de Strasbourg qui doit être inaugurée dans quelques mois. Cette nouvelle installation comprendra environ 1,200 lampes.

Berlin. — Une petite station centrale va être établie dans la Wilhelmstrasse, le quartier le plus distingué de Berlin. Le palais du prince de Bismarck, la chancellerie de l'Empire, les palais des princes Charles et Frédéric-Charles, la maison de banque Landau et autres se trouvent dans la partie de la rue qui sera éclairée par notre lumière.

Cologne-sur-Rhin. — La *Gazette de Cologne* (Cœlnische Zeitung) a commandé une de nos installations de 120 lampes pour ses bureaux et son imprimerie. Le matériel est déjà expédié. L'installation fonctionnera sous peu, et nous en parlerons plus longuement dans notre prochain bulletin.

Autriche-Hongrie.

Vienne. — Le plus beau et le plus grand café de Vienne, situé à côté du nouvel hôtel de ville, vient d'adopter définitivement notre système d'éclairage et de commander une installation complète de 250 lampes A, qui sera terminée au premier jour.

Buda-Pesth.—Les expériences que nous avons faites à Buda-Pest à l'Hôtel des Postes et Télégraphes nous ont valu le certificat suivant :

« Je soussigné certifie que M. Puskas a fait des expériences d'éclairage à l'hôtel des Postes et Télégraphes au moyen de 57 lampes A et 40 lampes B à incandescence système Edison, depuis le 20 mai jusqu'au 10 juin courant, de huit heures du soir à huit heures du matin, et que ces expériences ont réussi à tous les points de vue. La lumière des lampes est douce, constante et nullement désagréable pour

la vue. La chaleur produite par ces lampes est absolument nulle. C'est pour toutes ces raisons que ce système d'éclairage a obtenu l'approbation unanime de la Direction et de tout le personnel. »

Buda-Pesth, 20 juin 1882.

Signé : Louis KOLLER,
Conseiller ministériel et Directeur en chef du Département des Télégraphes.

Steyr. — Le succès qu'a obtenu notre installation de 60 lampes faite à titre d'essai dans la grande fabrique d'armes de M. Werndl (Oesterreichische Waffenfabricks Actiengesellschaft) a décidé son gendre, M. le comte Lamberg, à éclairer son château de Trautenfels par notre système. L'installation est terminée et fonctionne à merveille. M. Werndl a entamé avec nous des pourparlers pour éclairer toute sa fabrique avec nos lampes, et nous a fait annoncer qu'il viendra à Paris sous peu pour mener à bonne fin ces pourparlers. Il s'agit d'une installation de 4,000 lampes.

Brunn. — Le grand théâtre de la ville de Brunn, qui est en construction, va ouvrir le 31 octobre et sera entièrement éclairé par nos lampes. Plus de 800 lampes A, actionnées par quatre dynamos de 250 lampes chacun sont installées. C'est le premier grand théâtre sur le continent qui a adopté notre système à l'exclusion de tout autre mode d'éclairage et nous nous proposons d'en reparler dans notre prochain bulletin.

La ville nous a donné en même temps l'autorisation pour la pose des fils et des conducteurs dans les rues, et nous sommes occupés à établir une station centrale, qui éclairera des usines, cafés, clubs et maisons particulières.

Italie.

Bologne. — Le nouveau moulin à vapeur de MM. Franco et Cavelieri est éclairé par notre lumière. Une lettre, que nous avons reçue récemment, dit entre autres de cette installation, de 60 lampes A, qu'elle « a toujours fonctionné à « merveille depuis le premier jour. »

Milan. — Quatre grandes machines-dynamos de 1,200 lampes A chacune, destinées pour la première station centrale dans cette ville, sont parties de New-York, et probablement déjà arrivées à Milan. Le terrain nécessaire au centre de la ville est acheté par la Société italienne et la station commencera à fonctionner incessamment. Elle éclairera le théâtre de la Scala, deux ou trois autres théâtres, des magasins, des cercles, maisons particulières, etc. Le directeur général de la Société italienne se trouve en ce moment à New-York et a assisté à l'inauguration de la station centrale du premier district. Le journal « *Il Sole* » de Milan dit dans son numéro du 9 août.

La lumière électrique à la Scala. — Comitato per le applicazioni dell' Electricita « *Systema Edison* » *in Italia* a proposé à la Ville d'éclairer la scène de la Scala pendant la saison 1882-1883 et plus tard aussi la salle. Il est superflu d'insister sur l'utilité indiscutable de l'éclairage appliqué aux théâtres, d'autant plus qu'il s'agit d'applications de la lumière Edison, dont les essais ont toujours été couronnés par le succès le plus incontestable et le plus incontesté. Il ne peut y avoir aucun doute que notre Conseil municipal ne s'empresse d'accepter la proposition qui lui est faite de doter notre première scène des bienfaits de la lumière électrique.

Udine. — Nous avons fait à Udine une installation à titre d'essai, parce que cette ville a l'intention d'adopter

notre système pour éclairer tant les voies publiques que les maisons particulières. Nous reproduisons un article paru dans le journal d'Udine du 7 août.

Le premier essai de lumière électrique (Edison) qui ait été fait a eu lieu hier soir dans la « Loggia » et au « Mercato vecchio ; » il a pleinement réussi et a été entièrement satisfaisant sous tous les rapports. La rapidité avec laquelle toutes les lampes se sont allumées, atteignant en peu d'instants le maximum d'intensité, a favorablement impressionné le public dès l'abord. La lumière n'est pas blafarde comme celle des anciennes lampes électriques. Elle ressemble davantage à la lumière ordinaire et est beaucoup plus agréable pour la vue. Le plus grand avantage du nouveau système est encore la stabilité de sa lumière. Le vacillement du gaz ainsi que l'intermittence des lampes électriques des autres systèmes sont absolument supprimés.

A ces avantages assez importants déjà s'en joignent d'autres encore tels que la facilité de transmettre la lumière en un point quelconque au moyen de simples fils métalliques et la suppression de tout danger d'incendie, en sorte qu'il est permis de supposer que le jour où l'on sera mis en demeure de choisir entre la lumière électrique et le gaz, la victoire sera remportée par la première.

Belgique.

Anvers. — M. de Wael, bourgmestre de la ville d'Anvers, nous a adressé le certificat ci-dessous relatif aux essais faits par nous à l'Hôtel de Ville d'Anvers.

« Le Bourgmestre de la ville d'Anvers déclare que deux essais d'éclairage, au moyen de la lumière électrique (système Edison), ont été faits dans la salle de réunion du Conseil communal et que ces essais ont donné des résultats très satisfaisants. »

Anvers, le 2 août 1882.

Signé : Léopold de Wael.

MM. Gits Segers Cie ont éclairé leur grande raffinerie de sucre par une installation de 60 lampes A depuis le 28 avril. Ils nous ont, à la suite des expériences faites avec cette installation, exprimé le désir d'éclairer toute la fabrique, et nous ne doutons pas que les pourparlers aboutiront bientôt.

Bruxelles. — L'Installation que nous avons faite au musée du Nord a intéressé vivement tous les industriels belges, qui viennent de toutes les parties du pays pour la voir. Tout le monde est enchanté et nous recevons sans cesse des demandes.

Les huit installations suivantes sont en train d'être installées par nos ingénieurs et de nombreux pourparlers sont entamés depuis quelques jours :

MM. Desmet et Dhanis. Gand,	60	Lampes	A.
MM. Snyers, Beaudouin Cie .	30	lampes	B.
Charbonnages d'Aiseau Prèsles.	35	—	B.
Charbonnages du Boubier à Châtelet.	60	—	A.
MM. Godin et fils	120	—	B.
Société La Lys, Gand	40	—	A. et 40 B.

M. Ivan Simonis, Verviers. .	60	lampes	A.
MM. Beliard et Best, Anvers.	34	—	B.

La *Flandre libérale*, un des plus importants journaux de la Belgique, dit dans son numéro du 26 septembre à propos de la première de ces installations.

Nous avons assisté ce soir aux premiers essais d'éclairage à la lumière électrique qui se sont faits à Gand ; c'est à la fabrique de MM. Desmet et Dhanis, rue aux Laines, qu'ils ont eu lieu. Ces messieurs ont fait installer dans leur fabrique une machine dynamo-électrique alimentant 60 lampes système Edison, qui éclairent maintenant une partie de l'établissement.

Ces premiers essais ont dépassé toute attente ; la lumière produite par les lampes Edison est d'une fixité remarquable et d'une intensité beaucoup plus considérable que celle donnée par le gaz ; elle est en même temps fort douce et ne produit presque pas de chaleur. Cette supériorité de la lumière électrique sur la lumière du gaz, nous avons principalement pu la constater lorsque sortant de la partie de l'établissement éclairée par les lampes Edison, nous sommes entrés dans une autre partie encore éclairée par le gaz. Le contraste était frappant.

La machine électrique, avec tous ses accessoires, que M. l'ingénieur Rousseau, de Paris, est venu installer chez MM. Desmet et Dhanis, revient à 6,500 fr. ; cette dépense, une fois faite, il n'y a guère à remplacer annuellement que les lampes qui coûtent 7-50 fr. pièce. MM. Desmet et Dhanis comptent que déduction faite des frais d'amortissement, d'entretien, etc., ils réaliseront un bénéfice de 25 0/0 sur l'emploi de la lumière du gaz ; avec une machine dynamo-électrique alimentant un plus grand nombre de lampes l'économie serait encore plus forte.

MM. Desmet et Dhanis sont entièrement satisfaits de

l'expérience qu'ils viennent de tenter; tous ceux qui y ont assisté étaient unanimes à dire qu'elle était décisive. Le nouveau mode d'éclairage est excessivement simple et facile; il nous a paru aussi présenter de très sérieux avantages au point de vue des dangers d'incendie.

Nous apprenons que des lampes Edison viennent également d'être installées à la fabrique *la Lys*. Comme on le voit, nos concitoyens s'empressent de mettre à profit les dernières découvertes de la science.

Russie.

Tamersfors (Finlande). — MM. Finlayson et Cie, propriétaires d'une filature des plus importantes, ont fait des essais avec notre éclairage qui ont eu un résultat tellement satisfaisant que ces Messieurs nous ont commandé une grande installation de 1000 lampes B et 120 lampes A. Nos ingénieurs sont en ce moment occupés à terminer les travaux.

La grande fabrique de papier Angovois au nord de la Finlande vient d'adopter notre système d'éclairage en nous commandant une installation de 60 lampes A.

Helsingfors. — La papeterie Vaden vient d'adopter notre système d'éclairage, et le matériel, pour une première installation de 120 lampes B, a été envoyé.

La grande usine Nobel est éclairée, depuis le 1er février, par 120 de nos lampes A. M. Nobel a exprimé, à notre représentant, son entière satisfaction et recommande partout notre système d'éclairage de la façon la plus chaude.

Le théâtre Arcadia est éclairé depuis le 1er juin, par 140 lampes A. A l'occasion du bénéfice de la première chanteuse, notre représentant lui a offert un bouquet dans lequel se trouvait, entourée de roses, une lampe incandescente. Il est impossible de se faire une idée de l'enthousiasme du public qui voulait, à toute force, voir M. Edison.

Moscou. — Une installation de soixante lampes A fonctionne depuis le 1er juin au « Théâtre Ermitage » à Moscou, et le propriétaire en est aussi satisfait que le public. C'est en effet un grand avantage pour les théâtres d'avoir un éclairage qui ne développe plus de chaleur et qui permet ainsi au directeur de faire des affaires même en plein été. Sans parler du danger d'incendie, qui est absolument écarté par notre système.

Bogorodsk, près Moscou. — MM. Hutcheson et Cie, filateurs, ont imité l'exemple donné par la grande filature Finlayson et Cie, de Tamersfors, en adoptant notre système. Un de nos ingénieurs s'est rendu à Bogorodsk pour placer une installation de 320 lampes A.

Nigni-Novgorod. — Le Théâtre de M. Lentorsky est éclairé par 60 lampes A Edison depuis le 10 juin et tout le monde est unanime à louer notre lumière.

La Compagnie des bateaux à vapeur Kaukase et Mercure vient d'adopter notre système. Nous avons fait une installation de 120 lampes B. qui fonctionne depuis le 1er août à bord du steamer Grand-Duc Souvoroff et nous sommes en pourparlers pour les autres bateaux de la dite Compagnie.

Taganrok. — M. Alferaky a fait installer dans son moulin à vapeur 60 de nos lampes A. Il a dit à notre représentant qu'il est très satisfait de notre lumière, qui est brillante et superbe et dont le prix de revient est minime.

Kieff. — Nous sommes en train de faire installer 60 lampes B et 30 lampes A dans la gare du chemin de fer de Karkok-Kieff qui fonctionneront sous peu.

Varsovie. — Une de nos petites installations (E de 17 lampes A ou 34 lampes B) va être faite à Varsovie, pour servir à des expériences et des démonstrations publiques.

Hollande.

Amsterdam. — La Nederlandsche Electriciteits Maatschappy (Société Néerlandaise d'Electricité) vient de se constituer. Elle exploite surtout notre système et après avoir fait une installation de 60 lampes A dans le café le plus en renom d'Amsterdam (café Krasnopolsky) pour se rendre compte du système, elle a commandé et déjà reçu les machines nécessaires pour deux stations centrales, dont une à Amsterdam, l'autre à Rotterdam. Elle a signé en outre un traité avec une grande raffinerie en construction pour l'éclairer entièrement par notre lumière (250 lampes A). Six autres dynamos, dont un K (250 lampes) trois Z et deux E sont également commandées par la même Société pour six installations isolées.

Comment pourrions-nous terminer ce bulletin sans parler, quoique se trouvant en dehors de notre rayon d'activité de l'expérience concluante qui a été faite le 6 septembre à New-York, où la station centrale éclairant le premier district de cette ville a été inaugurée par l'homme éminent auquel nous devons déjà tant d'inventions miraculeuses et qui nous promet encore bien des surprises. En publiant les détails merveilleux nous nous inclinons devant M. Edison et nous le remercions de tout le bien qu'il procure à l'humanité.

La station centrale de Pearl Street a été éclairée dans la nuit du 6 au 7 septembre sur six mille de conducteurs de rues comprenant cent immeubles, avec trois à cent lampes chacun, dans toutes les directions autour de la station jusqu'à un kilomètre de distance. Dix à vingt immeubles sont ajoutés chaque jour. Tous les abonnés ont leur lumière jour

et nuit sans interruption; beaucoup d'abonnés ont déjà fait enlever leurs compteurs à gaz; ils paient le même prix que pour le gaz. Voici quelques extraits de journaux :

Hérald : Dans les bureaux et magasins il y avait la nuit dernière une lumière inaccoutumée; c'était la lampe incandescente Edison qui fonctionnait pour la première fois pour l'éclairage du premier district; l'effet était éminemment satisfaisant, le fer à cheval lumineux a bien travaillé.

Le *Times* : Les dynamos géants ont commencé à marcher à trois heures; ils continueront toujours à moins d'être arrêtés par un tremblement de terre. La lumière est plus brillante que le gaz et cent fois plus fixe. Vingt-sept lampes électriques dans nos salles de la rédaction et vingt-cinq dans les dépendances rendaient nos bureaux aussi clairs qu'en plein jour et sans aucun reflet déplaisant. La lumière est telle qu'un homme peut travailler à son aise pendant plusieurs heures sans s'apercevoir qu'elle est artificielle. Cette lumière est douce et agréable à l'œil; elle est sans vacillement et sans chaleur. Elle a été essayée la nuit dernière par des hommes dont les yeux étaient abimés par un travail de nuit de plusieurs années; ils sont unanimes en faveur de la lampe Edison contre le gaz.

Le *Sun* dit : Les bureaux de Drexel, Morgan et C^ie du *New-York Times*, de la *Park Bank* et du *New-York Hérald* étaient parmi les immeubles éclairés la nuit dernière. Edison, très satisfait, disait à notre reporter : J'ai accompli tout ce que j'ai promis, mais je n'étais pas sans appréhension lorsque j'ai fait marcher les machines ce soir. J'ai presque craint que quelque phénomène imprévu ne vînt contrarier mon éclairage, mais il a entièrement réussi. On nous demande plus de lumière que nous n'en pouvons fournir, vu le manque d'hommes expérimentés pour la pose des conducteurs.

Le *World* dit : La plupart des principaux magasins de Fulton Street et d'autres endroits du district étaient éclairés la nuit dernière pour la première fois et continueront à l'être par une station centrale. Des électromètres ont été placés dans les immeubles qui sont inspectés par le comité des compagnies d'assurances avant que tout éclairage ait commencé. Les lampes sont plus brillantes que la lumière du gaz et peuvent être allumées et éteintes à volonté sans le moindre danger. On peut appliquer le plus fin mouchoir autour de la lampe, casser la lampe avec un marteau, le mouchoir ne sera pas même roussi.

De nouvelles dépêches nous informent que sur 1,500 abonnés au gaz que comptait le premier district de New-York, 1,100 se sont déjà fait inscrire à la station centrale Edison.

1210 PARIS. — IMPRIMERIE CHARLES BLOT, RUE BLEUE, 7.

C21.309
1883-02-15

CHAS. BATCHELOR.

N° 3. Paris, 15 Février 1883.

Compagnie Continentale Edison

SOCIÉTÉ ANONYME AU CAPITAL DE **Un Million** DE FRANCS

PARIS. — 33, Avenue de l'Opéra. — PARIS

ÉCLAIRAGE

PAR STATIONS CENTRALES

DE

VILLES, RUES, ÉDIFICES PUBLICS & PARTICULIERS,

Châteaux, Magasins,

THÉATRES, USINES, MUSÉES, HOPITAUX, CAFÉS, ETC.

CONSEIL D'ADMINISTRATION :

M. CHARLES PORGÈS, président. M. J.-F. BAILEY, adm.-délégué.
M. AUG. MAGNIN, vice-présid. M. LOUIS RAU —

MM. CHARLES BATCHELOR, administrateur.
EDOUARD LEBEY —
GEORGES LEBEY —
ELIE LÉON —
THÉODORE PUSKAS —
LÉON RENAULT —

TROISIÈME BULLETIN

Première station centrale de New-York.

Dans notre deuxième bulletin, daté du 10 octobre, nous avons annoncé l'inauguration, à la date du 4 septembre précédent, de la **première station centrale** de New-York. Dans le courant de novembre, des journaux de Berlin ayant annoncé que cette station centrale ne fonctionnait pas avec succès, M. Brewer, consul général des Etats-Unis à Berlin, a télégraphié à M. Osborn, inspecteur du comité des Compagnies d'assurances à New-York, pour lui demander des renseignements sur le fonctionnement de cette station centrale ; nous donnons ci-après la réponse de M. l'inspecteur Osborn:

TÉLÉGRAMME

A Monsieur S. G. Brewer, Consul Général des États-Unis à Berlin.

New-York, le 24 novembre 1882.

« En réponse à vos questions par câble, je vous informe que la Compagnie Edison, de cette ville, a actuellement installé 2709 lampes qui sont alimentées par sa station centrale. Je les ai toutes examinées et acceptées, et le Comité des Compagnies d'Assurances de New-York a donné des certificats pour ces lampes. Elles sont installées dans 191 immeubles. Le nombre des dynamos marchant pendant la journée est de deux ; trois dynamos fonctionnent de 4 à 7 heures du soir. Dans les immeubles ci-dessus mentionnés il y a des fils posés pour 4288 lampes ; d'ici au 1er décembre j'aurai complété l'inspection de 1,000 lampes de plus, qui rendront

nécessaire l'emploi de 4 dynamos. La Station Centrale ne s'est pas arrêtée un seul instant jour et nuit depuis qu'elle a commencé à fonctionner le 4 septembre. »

« *Signé* : R. S. OSBORN. »

« Inspecteur du Comité de New-York et des Compagnies d'Assurances. »

Depuis l'envoi de ce télégramme M. le Major Eaton, président de la Compagnie Electrique Edison des Etats-Unis, nous a télégraphié :

« La Station obtient un parfait succès : la marche n'a jamais été interrompue depuis l'inauguration du 4 septembre ; nous éclairons maintenant 227 maisons dans lesquelles les conducteurs sont posés pour plus de 5.000 lampes ; les clients sont satisfaits de la lumière et du prix auquel elle leur est vendue. »

Comme complément à cette dépêche nous ajoutons les renseignements suivants qui nous sont parvenus officiellement de la Compagnie Edison de New-York :

« Tous les abonnés de la Station Centrale de M. Edison, à New-York, ont été questionnés par la Compagnie sur leur opinion au sujet de la lumière Edison. Tous ont répondu, sans exception, que, non seulement ils en étaient très contents, mais même qu'ils ne pourraient plus s'en passer. Certaines personnes, hostiles à l'éclairage électrique, ayant fait circuler le bruit que l'isolation des conducteurs n'était pas parfaite et qu'il y avait des pertes de courants, M. Edison a fait dire par les journaux de New-York que ce bruit était absolument faux, invitant qui que ce soit à faire contrôler par des électriciens compétents le fonctionnement de la Station centrale. »

Les machines pour l'éclairage de la deuxième partie du réseau sont en cours d'installation dans la Station centrale de Pearl Street ; l'achèvement de ce travail permettra d'actionner plus de 15.000 lampes dont les conducteurs sont déjà posés.

Deuxième station centrale de New-York.

On reçoit en ce moment les souscriptions pour la deuxième Station centrale de la ville de New-York, et les travaux doivent commencer au printemps.

Compagnie américaine des Installations isolées

Nous avons reçu le rapport du Conseil d'Administration qui a été présenté à la première Assemblée Générale des actionnaires de la Compagnie Américaine des installations isolées qui a eu lieu le 21 novembre 1882.

Cette Compagnie est formée au capital de 2.500.000 francs, dont 51 0/0, soit 1.275.000 francs en actions complètement libérées ont été versés à la Compagnie mère, comme prix de la licence des brevets, laissant un capital en numéraire de 1.225.000 francs.

Le premier exercice a produit un bénéfice net de 290,738 fr., permettant de distribuer un dividende de dix pour cent sur tout le capital-actions et de constituer de plus une réserve.

Les affaires de cette Compagnie, jusqu'au 19 novembre 1882, ont porté sur 137 installations isolées d'une importance variant de 15 à 800 lampes chacune. Ces installations ont été faites dans des filatures, usines, hôtels, bateaux à vapeur, bureaux de journaux, magasins de nouveautés, etc., etc.

Le nombre total des lampes employées dans ces installations est de 25,426.

Les offices de journaux éclairés par des installations Edison sont : le *New-York Herald*, le *Philadelphia Ledger*, le *Philadelphia Record*, le *Ohio State Journal*, le *Boston Herald*, le *Baltimore Sun*, le *Davenport Gazette* ainsi que l'imprimerie et les bureaux de MM. Weed, Parsons et Cie à Albany.

Pour toutes les parties du travail que comporte l'impression des journaux, la lumière Edison a été reconnue comme constituant un précieux moyen d'éclairage artificiel à cause de sa fixité et parce qu'elle ne dégage aucune chaleur.

Notre lumière parait donner satisfaction à tous les clients, car on a reçu d'eux un nombre considérable de témoignages qui tous proclament les mérites incontestables de la lumière Edison.

La meilleure preuve de cette satisfaction est fournie par le fait qu'aucune des installations faites à l'essai n'a été abandonnée, mais qu'au contraire beaucoup ont été agrandies.

Le directeur des **Wamsutta Mills** écrivant à un journal américain, donne les renseignements suivants sur le système d'éclairage Edison qui fonctionne dans cette fabrique :

« L'installation a coûté environ 60,000 fr. Elle est com-
» posée de 3 dynamos K., alimentant chacun 250 lampes de
» 16 bougies. Une seule lampe éclaire 4 métiers et donne une
» lumière égale à chacun d'eux. Dans les autres parties
» de la fabrique l'arrangement est tel qu'une lampe éclaire
» l'espace précédemment éclairé par 2 becs de gaz brûlant
» 4 pieds cubes par heure. Depuis le premier essai, tout a
» marché parfaitement. La lumière électrique Edison est
» aussi bon marché que le gaz, à 5 fr. les 1,000 pieds cubes ;
» de plus, cette lumière ne produit ni fumée, ni chaleur ;
» elle est beaucoup moins dangereuse que le gaz et ne vicie
» pas l'air. Les dynamos sont surveillés par un des mécani-
» ciens de l'usine et n'exigent que très peu de soins. La force
» motrice nécessaire est évaluée à un cheval-vapeur pour
» 8,6 lampes de 16 bougies chacune.
» Si la force motrice est prise sur une machine existant
» déjà dans une usine, les frais d'exploitation de l'installation
» électrique sont insignifiants.
» Les frais d'éclairage électrique de notre fabrique, qui
» contient 1,072 métiers de 40 pouces chacun et 50,000
» bobines, sont évalués, par an, à fr. 8,430, y compris l'in-
» térêt et l'amortissement de l'installation.

INSTALLATIONS EN EUROPE

France.

Paris. — A l'époque de la publication de notre deuxième bulletin, nous n'avions, à Paris, qu'une seule installation, celle de la **gare St-Lazare** où deux de nos dynamos Z. actionnent 115 lampes A. et 4 B. éclairant la rotonde de St-Germain, les guichets des lignes de Normandie, divers

bureaux et les quais des Messageries de grande vitesse; cette installation fonctionne depuis le 9 septembre 1882 sans interruption et à la satisfaction générale.

Depuis, nous avons fait, à Paris, les installations suivantes :

Magasins du Bon Marché

Deux machines K. de 250 lampes A. chacune, soit, 500 foyers, placés dans les sous-sols et dans divers rayons du rez-de-chaussée.

Les lampes destinées à l'éclairage du sous-sol, où elles brûlent 12 heures par jour, sont adaptées directement contre le plafond.

Cette disposition, qui serait absolument impossible à appliquer avec tout autre mode d'éclairage, est très avantageuse dans l'espèce, où il s'agit d'éviter d'accrocher les appareils d'éclairage en manipulant des ballots de marchandises.

Dans les magasins du rez-de-chaussée, les lampes sont placées par groupes de 3, 4 et 6 sur les appareils à gaz existants.

Banque de France.

IMPRIMERIE DES BILLETS

Installation faite sur l'initiative de M. Ermel, Ingénieur en chef de la fabrication des billets.

Eclairage par 20 lampes A. et 64 lampes B. de la salle de l'Imprimerie et des salles de comptage des billets.

Dans ces dernières salles, qui ne reçoivent qu'un mauvais jour, le gaz restait allumé pendant une partie de la journée et la température était donc souvent très élevée (30° le soir) ; depuis l'emploi du système Edison elle ne s'élève plus qu'à 18° en moyenne et l'atmosphère est sensiblement assainie.

Conseil Municipal

Nous éclairons, au Pavillon de Flore, la salle de commissions n° 6, et l'Imprimerie municipale, au moyen d'un dynamo Z. et de 60 lampes A. ; nous avons fait une soumission pour l'éclairage de la salle des séances du Conseil Municipal.

Loddé fils, fabricant de plumeaux, rue Stephenson

1 machine Z. 48 lampes A. et 14 B.

Eclairage industriel des salles de vérification des plumes, de tours à bois, etc. ; depuis que notre éclairage existe, on arrive à trier les nuances des plumes à la lumière.

Pochet, verrerie, Quai Valmy

Eclairage par une machine E.

6 lampes A. et 20 B. Ateliers de mécanique et d'émerisage des flacons.

Magasins du Louvre

1 machine Z. 60 lampes A.

Eclairage de différents bureaux pendant *toute la journée*. Dans ces pièces, très basses, il régnait une température insupportable. Les employés sont donc très satisfaits de l'emploi du système Edison.

Lahure et Cie, rue de Fleurus. Imprimerie

1 machine Z. 60 lampes A. éclairant des machines à journaux, des salles de pliage, etc.

Hachette et Cie, rue Stanislas

Eclairage avec 78 lampes B. et 22 lampes A. de magasins et de salles de reliure, par une machine Z.

Hôtel Continental

Eclairage du restaurant par 1 machine Z,, 60 lampes A., réparties sur 3 lustres.

On remarquera le nombre déjà considérable d'imprimeries éclairées par le système Edison; le *Gutenberg Journal* a publié à ce sujet un intéressant article dans son numéro du 30 janvier 1883, nous en citerons les passages suivants :

ÉCLAIRAGE DES IMPRIMERIES

Dans notre numéro du 19 décembre nous avons entretenu nos lecteurs de l'éclairage électrique appliqué aux théâtres ; aujourd'hui nous parlerons de l'application du même éclairage aux *imprimeries*.

Dans ce genre d'industrie la lumière joue un rôle très important.

En effet, depuis longtemps déjà la lumière du gaz est reconnue insuffisante, surtout pour les travaux de composition.

Différents essais ont été tentés en vue de remplacer le gaz par la lampe à arc voltaïque; mais les résultats obtenus n'ont pas été satisfaisants à cause des ombres que projette cette lumière.

La lumière électrique par incandescence Edison paraît, au contraire, remplir toutes les conditions désirables pour ce genre d'éclairage.

Plusieurs imprimeries importantes l'ont déjà adoptée. Nous citerons entre autres:

L'imprimerie municipale de la ville de Paris, dans laquelle chaque compositeur a, au-dessus de son rang, une lampe Edison munie d'un abat-jour qui projette la lumière sur les casses et les éclaire d'une façon absolument uniforme.

Les marbres sont éclairés de la même façon.

Les compositeurs sont charmés de ne plus être gênés ni par la chaleur ni par la mauvaise odeur produite par le gaz.

L'imprimerie des billets de la Banque de France est également éclairée par des lampes Edison. Les machines en blanc ont chacune deux lampes : l'une montée sur un chandelier portatif sert au margeur; l'autre est montée sur le dessous de la table qui reçoit la feuille à marger et éclaire le receveur. Cette disposition donne les meilleurs résultats toutes

les fois que les feuilles doivent être vérifiées de suite, comme par exemple pour un tirage de luxe ou pour un numérotage.

L'imprimerie Lahure a également adopté le système Edison pour ses nouveaux bâtiments. Les machines à journaux sont éclairées chacune par deux lampes montées sur tige à genouillère dont la forme varie avec chaque machine. Des lampes placées le long du mur fournissent l'éclairage général; les salles de pliage sont aussi éclairées par ces lampes; des appareils descendent du plafond et répartissent la lumière sur les tables de pliage.

La maison Hachette et Cie fait en ce moment installer le même éclairage dans ses ateliers de reliure, ainsi que dans ses magasins de la rue Stanislas. Des appareils de toutes formes éclairent les divers travaux de dorure sur tranche, dorure au balancier, et, en général, tous les travaux de l'atelier.

Dans les magasins où les papiers s'empilent jusqu'au plafond on a placé les lampes directement contre le plafond même, la saillie totale ne dépasse pas 15 centimètres et cette disposition, en même temps qu'elle permet d'éclairer toutes les étiquettes des rames de papier, donne la plus grande facilité de circulation aux hommes qui portent les charges sans appréhension d'accrocher les appareils d'éclairage

L'avantage sur tous les autres systèmes est évident. La lumière Edison est fixe et ne vacille pas au moindre courant d'air; elle est d'un ton doré agréable et d'un éclat qui ne fatigue pas la vue. Elle ne laisse pas, comme le gaz, sous la menace perpétuelle de l'incendie ou de l'explosion.

On peut affirmer que c'est la lumière qui offre à la fois la sécurité la plus absolue et les conditions hygiéniques les meilleures ; elle est sans rivale sous ce double rapport et ne peut être comparée à aucun autre mode d'éclairage.

Installations dans les Départements.

Il nous est impossible, dans les limites que nous devons nous imposer pour ce bulletin, de donner une description détaillée de toutes les installations que nous avons faites dans les Départements ; nous devons nous borner à en donner la

liste avec indications des machines et du nombre de lampes formant les installations ; nous prions les personnes désireuses d'obtenir des renseignements sur les avantages de notre système de vouloir bien s'adresser aux propriétaires de ces installations, qui toutes fonctionnent de la manière la plus parfaite et la plus satisfaisante. Nous citerons comme exemple celle de Monsieur **Jh Bardou et fils**, de **Perpignan**, la première usine que nous ayions éclairée en France ; ces Messieurs nous écrivent, en date du 3 février 1883 :

« Nous marchons admirablement et ne cassons plus du » tout de lampes ; une rarement, par ci, par là. »

NOMS	VILLE	INDUSTRIE	DYNAMO	LAMPES	
				A	B
Ph. Bazin	Condé-sur-Noireau	Filature	1 Z	41	32
Ch. Colliard	Au Câteau	Tissage	1 Z	»	120
Poudrerie nationale de Saint-Chamas	St-Chamas	Poudrerie	1 Z	60	»
Expos. de Bordeaux	Bordeaux	Exposition	2 Z	120	»
J. Bardou et fils	Perpignan	Fabrique de papiers	1 Z	60	»
P. Schmitt fils	Saint-Dié	Bonneterie	1 Z, 1 E	10	130
Fénal frères	Péxonne	Faïencerie	1 Z	40	40
J. Luc	Nancy	Manufacture de cuirs	1 Z	60	
R. Loeffel et Cie	Blainville (Meurt.-et-Mos.)	Filature	1 Z, 1 E	77	
Clerget	Vesoul	Fabrique de pâtes alimentaires	1 Z	60	
Ed. Lefebvre	Pont-Authou	Filature	1 Z	60	
Lepage et Cie	Louviers	Filature	1 Z	60	
L. Lefebvre	Roubaix	Filature	1 Z	40	40
Motte et Meillassoux	id.	Teinturerie	1 Z	40	40
A. Laroche-Joubert et Motteau	Angoulême	Construct. de machines	1 Z	60	
P. Dandicolle fils et Gaudin aîné	Bordeaux	Négociants	1 Z	60	
Chaveau	Toulouse	Café	1 Z	40	40
Ch. Sabatié	Mazamet	Négociant	1 Z	60	»
B. Sirven	Toulouse	Fabrique de papeterie	1 Z	17	»
G. Gerbaud	Narbonne	Négociant	1 Z	17	»

Autriche-Hongrie.

Vienne. — Nous venons d'avoir un grand et très légitime succès. Le ministère de la Cour d'Autriche, qui n'a jamais permis l'emploi du gaz dans le palais impérial, nous a fait inviter à éclairer deux grandes salles pendant les **bals de la Cour.** Nous avons remplacé par cinq cents de nos lampes trois mille bougies employées précédemment à cet éclairage, et le succès a été complet. Ce qui frappait tout le monde, c'était surtout, en dehors de la belle fixité de notre lumière, le peu de chaleur qu'elle développait. Tandis que la température des salles éclairées par des bougies dépassait trente degrés vers une heure du matin, la chaleur dans les salles éclairées par nos lampes n'atteignait pas vingt degrés. On ne parle, à Vienne, que du grand triomphe des lampes Edison.

Brünn. — Nous parlerons encore une fois du **théâtre municipal** de la capitale de la Moravie, où le succès de notre éclairage s'accentue de jour en jour. Depuis le commencement de l'éclairage, c'est-à-dire depuis plus de trois mois il n'y a pas eu la plus petite interruption à enregistrer. Un journal compétent écrit sur cette installation :

« Pendant que les directeurs de théâtres, les municipalités et même les gouvernements de tous les pays s'occupent de la question brûlante de l'éclairage des théâtres, la capitale de la Moravie, grande par l'intelligente initiative de sa municipalité, et par le rang qu'elle occupe dans le monde commercial et industriel, a pris les devants en employant, à l'exclusion de tout autre système, la lumière Edison pour l'éclairage de son nouveau théâtre.

Le 14 novembre, date de l'inauguration, fera époque dans les annales théâtrales, et l'émotion qu'ont ressentie ce jour-là les habitants de Brünn était bien légitime. Car malgré les études approfondies auxquelles s'est livrée la commission instituée par la municipalité pour choisir le meilleur système, études qui ont été conduites avec toute la sagacité et toute la compétence qu'un tel sujet comportait, ce projet n'en était

pas moins considéré comme un pas des plus hardis tenté dans cette voie.

Nous allons résumer en peu de mots les principaux détails de son installation.

C'est à une distance de 315 mètres du théâtre que se trouve situé le bâtiment des machines occupant une superficie de 249 mètres carrés et comprenant : 1° la chambre de chauffe à vapeur et 2° la salle des machines.

Les chaudières, au nombre de trois, sont emmurées les unes à côté des autres.

Chaque chaudière est composée d'un bouilleur horizontal et d'un corps tubulaire adapté au précédent; dans ce dernier les tubes sont en quatre groupes; leur nombre total est de soixante-huit.

Deux chaudières étant suffisantes pour l'exploitation normale de la machine à vapeur, il y en a toujours une en réserve.

Ces chaudières, munies de tous les appareils nécessaires de chauffage et de sûreté, sont alimentées par les eaux de la ville au moyen d'une pompe à vapeur fixée au mur.

Les chaudières sont timbrées pour une pression de sept atmosphères, et c'est à cette même pression que se fait l'admission pour la machine à vapeur. La cheminée commune des chaudières a trente mètres de hauteur.

Dans la salle des machines se trouvent, à côté du moteur à vapeur à haute pression d'une force de 110 chevaux, quatre machines dynamo-électriques Edison.

La production de l'électricité dans ces machines est obtenue en faisant tourner, à raison de 900 tours à la minute, un noyau de fer doux dans le champ d'induction.

Par ce moyen, la force motrice de la machine à vapeur se change en électricité et le courant électrique, au moyen d'un câble principal d'une longueur de 315 mètres, est dirigé vers le théâtre où s'opère sa distribution.

Chaque machine dynamo-électrique Edison peut alimenter 250 lampes à incandescence Edison de la force normale de seize bougies.

Le câble qui relie les machines au théâtre se compose de deux barres de cuivre de forme demi-ronde entourée de matières isolantes et contenues dans un tube de fer forgé qui les préserve de toute influence extérieure. En raison de la tension minime du courant on peut, sans aucun danger, toucher les conducteurs; l'accouplement des tubes du câble est aussi fait d'une façon très ingénieuse.

L'intérieur du théâtre est éclairé par huit cent vingt lampes réparties dans la cage du grand escalier, le foyer, les couloirs, la salle, les loges des artistes et enfin la scène.

L'éclairage de la scène présente un intérêt tout particulier : chaque herse supporte quatre-vingt-dix-neuf lampes, dont un tiers est destiné aux effets de lumière blanche. Un tiers est composé de lampes rouges, le dernier tiers de lampes vertes. Tous les effets de lumière peuvent être ainsi facilement obtenus en allumant tout ou partie des lampes de chaque couleur. La rampe supporte cent vingt lampes établies dans les mêmes conditions.

La lumière produite sur la scène par ces différents effets combinés est des plus heureuses ; elle dépasse tout ce qui a été obtenu dans ce genre jusqu'à ce jour par le charme inexprimable et le velouté que cette lumière donne à tous les effets de scène. A ce propos nous avons à parler de l'appareil le plus ingénieux et le plus important en ce qui concerne l'éclairage de la scène et de la salle : c'est le régulateur qui est placé dans un coin de la scène : là se rassemblent tous les fils conducteurs, une véritable forêt! Le tout est symétriquement arrangé et n'occupe qu'une place relativement insignifiante.

Grâce à cet appareil, il est possible d'obtenir, tant dans la salle que sur la scène, depuis la plus éclatante clarté jusqu'à la nuit, en passant par toutes les transitions voulues.

La salle est éclairée par un lustre principal ayant deux rangées de lampes incandescentes.

Le long du pourtour des loges sont installées des appliques portant chacune une lampe enfermée dans un globe dépoli.

Enfin, sous tous les rapports, l'expérience a été concluante. La preuve en est constatée par l'enthousiasme croissant que manifestent toutes les personnes qui s'occupen de cette question.

Chaque jour, des sommités de tous les pays sont attirées par l'intérêt que comporte cette innovation et qui modifie de fond en comble la situation actuelle des théâtres en leur assurant la plus complète sécurité au point de vue des dangers d'incendie; jusqu'à ce jour, cette sécurité leur a fait complètement défaut malgré les nombreuses mesures de précaution imposées aux directeurs par les règlements et qui ont été prises après les terribles catastrophes de ces dernières années. »

Nous parlerons, dans notre prochain Bulletin, des autres installations que nous sommes en train de monter en Autriche-Hongrie et qui sont très nombreuses et très importantes.

Belgique.

Bruxelles. — On vient de monter à titre d'essai une installation de 120 lampes A à la **Chambre des députés.** Le succès a été aussi grand que partout ailleurs. Nous pouvons, en effet, dire sans exagérer « autant d'installations autant de succès. »

L'installation du **Théâtre Royal du Parc** sera terminée dans quelques jours. Nous donnerons des détails intéressants à ce sujet dans notre bulletin N° 4.

Le nombre des usines éclairées par notre système augmente de jour en jour. Ce sont surtout les filatures qui de préférence adoptent notre lumière. La plupart des grands industriels qui ont fait à l'essai des installations de notre lumière sont en pourparlers pour augmenter le nombre des lampes et pour éclairer entièrement leurs usines par la lampe Edison.

Voici le passage d'une lettre de MM. **E. L. Godin et fils,** fabricants de papier à **Huy,** qui nous écrivent en date du 4 décembre 1882 : « Nous vous informons que nous sommes » toujours très satisfaits de notre éclairage Edison. »

D'un autre côté, MM. **Béliard et Best,** à **Anvers,** nous disent : « Nous ne voulons pas attendre plus longtemps pour » vous écrire au sujet de votre éclairage dont nous sommes » très satisfaits; il nous procure une très notable économie » sur nos frais d'éclairage. »

Hollande.

Amsterdam. — Une **Station Centrale** (1,000 lampes A) sera terminée et commencera à fonctionner au mois d'avril. Les dynamos sont expédiés, les machines motrices et les chaudières sont montées, et la pose des câbles va commencer dans quelques jours.

Le **Café Krasnopolski,** est toujours éclairé par nos lampes, qui brûlent maintenant depuis le mois de juillet 1882 à la grande satisfaction du public et du propriétaire.

La **minoterie Reynvaan** est également éclairée par nous. Depuis sa mise en marche, au mois de septembre, l'éclairage fonctionne à merveille.

Même succès dans la grande **raffinerie de sucre** « Wester Suikerraffinadery » éclairée par 360 lampes A actionnées par 2 dynamos K.

Rotterdam. — Les travaux pour la **Station Centrale** sont très avancés; nous espérons qu'elle pourra commencer à fonctionner en même temps que celle d'Amsterdam.

Allemagne

Strasbourg. — Nous avons parlé dans notre bulletin N° 2 de l'installation qui fonctionne à la **gare** de cette ville depuis treize mois. Quelques-unes des lampes de la première pose brûlant encore ont atteint actuellement une durée de plus

de 3,000 heures. La direction des chemins de fer Impériaux, d'Alsace-Lorraine, nous avait demandé un devis pour l'éclairage de la **nouvelle gare centrale**, et nous venons de recevoir la commande y relative. On installera pour le moment 3 dynamos K (250 lampes de 16 bougies chacun) mais le nombre des lampes sera augmenté l'année prochaine et nous placerons alors 2 dynamos K de plus. Le montage de cette importante installation commencera dans le courant de ce mois.

Dresde. — L'installation dans la **fabrique de pianos** de M. Emile Ascherberg (250 lampes A) fonctionnne maintenant depuis 2 mois. Le propriétaire de la fabrique nous fait les plus grands éloges.

Le **théâtre de la Cour** fait dans ce moment des essais avec une petite installation de 60 lampes A, placées sur la scène. La direction a l'intention d'adopter notre système.

Munich. — L'installation de notre lumière au **Théâtre Royal (Residenztheater)** est presque terminée et fonctionnera sous peu. Nous sommes occupés, en ce moment, à construire le régulateur pour les effets de lumières.

Dès que l'éclairage aura commencé nous en reparlerons à nos lecteurs.

Dantzig. — **Le chantier de la Marine impériale** (Werft) est éclairé par 120 de nos lampes A. Nous savons que les autorités allemandes sont très satisfaites des résultats. Nous attendons un rapport détaillé concernant cette installation et nous le publierons ultérieurement.

Canstatt (Wurtemberg). — MM. **S. Lindauer Cie**, fabricants de corsets, écrivent au sujet d'une installation de 130 lampes B. qui fonctionne depuis quelque mois dans leurs ateliers.

« L'éclairage installé par vous fonctionnant depuis un » certain temps maintenant, nous sommes heureux de pou- » voir vous confirmer que nous en sommes entièrement sa- » tisfaits.

« La machine dynamo Edison fonctionne d'une façon » tout à fait régulière, et sans s'échauffer, et sans produire » d'étincelles. Tout en faisant son service ordinaire, notre » mécanicien peut la surveiller facilement, tellement la con- » duite en est simple.

« Le pouvoir éclairant des 130 lampes B. actuellement » placées étant tout à fait satisfaisant, nous avons l'intention » d'en installer 60 de plus. La lumière des lampes est d'une » fixité remarquable, très agréable pour les yeux et, qui » mieux est, nos ouvriers ne sont pas gênés par la chaleur. »

« Malgré l'importance relative des frais de premier éta- » blissement, nous pouvons dès à présent constater une » économie notable en comparaison de l'éclairage au gaz. »

« Canstatt, 31 janvier 1883. »

Signé : S. Lindauer Cie

Nous recevons tous les jours des commandes de toutes les parties de l'Allemagne. On installe notre lumière dans presque toutes les grandes villes. La place nous manque aujourd'hui pour parler de chaque installation dans tous ses détails, mais nous publierons bientôt un bulletin spécial des installations allemandes.

Italie.

Milan. — Nous avons déjà dit (dans le bulletin n° 25, que les quatre grands dynamos de 1200 à 1400 lampes A chacun, étaient partis pour Milan. On est maintenant occupé à installer les moteurs et les chaudières. La pose des câbles souterrains est terminée et la **Station centrale de Milan**, la première sur le continent, fonctionnera probablement le mois prochain.

Des installations isolées fonctionnent déjà à :

Bologne. — Chez MM. **Franco et Cavalieri**, moulin à vapeur.

Solbiate. — Chez M. **A. Ponti**, filature.

Vaprio. — Chez M. **B. Crespi**, filature.

Bergamo. — Chez M. **Crespi**, filature.

Pise. — Chez M. **Giacomo Nissim**, filature.

Pegli. — Chez MM. **Cassanello frères**, moulin à vapeur.

Vigerami. — Chez MM. **G. Crespi & Cᵒ**, filature.

Lac Majeur. — Chez M. **A. M. Crossi**, filature.

Turin. — Chez M. **Lemann et Cᵒ**, filature.

Rome. — A l'Ecole des Beaux-Arts.

Toutes ces installations fonctionnent admirablement depuis le premier jour.

Russie.

Depuis notre dernier bulletin **une grande raffinerie de sucre à Josefow** (Pologne) est éclairée par 140 lampes A (2 dynamos Z et 1 dynamo E). Un grand nombre de machines dynamo-électriques sont en ce moment en route pour la Russie; mais comme nous ne voulons parler que des installations isolées déjà établies, nous nous réservons d'en parler plus tard.

La **station centrale de St-Pétersbourg** sera inaugurée bientôt. Toutes les machines et tout le matériel électrique sont maintenant expédiés et nos ingénieurs commencent les travaux.

Ingerois (Russie). L'Ingénieur en chef de la **Société des usines à Papier** de cette ville écrit en date du 30 décembre :

« Au nom de la Société des Papeteries d'Ingerois je tiens » à vous faire part des résultats obtenus avec l'éclairage » électrique que vous avez établi à son usine pour la pâte et » le carton de bois à Ingerois, dans le courant du mois de » septembre passé.

» Cet éclairage se compose d'une machine dynamo-élec- » trique mise en mouvement à volonté au moyen d'une tur- » bine ou d'une machine à vapeur et 60 lampes, employées

» dans les différentes parties de l'usine, dans les cours, » comptoirs, écuries. Elles remplissent parfaitement leur but » et donnent une lumière très agréable pour le travail des » machines, le triage des cartons, ainsi que dans les séchoirs, » où elles excluent tous risques d'incendie.

» Nous sommes très contents de votre éclairage électrique » qui a résolu, pour nous, le problème d'une bonne lumière » économique et en même temps exempte des dangers d'in- » cendie que présente le gaz ou le pétrole. »

« Pétersbourg, 30 décembre 1882. »

Signé : Masset.

Nous recevons, de plus, un certificat de la direction de la Compagnie **Kaukase et Meroure**, ainsi conçu :

« La direction de la Compagnie *Kaukase et Mercure* » pour la navigation à vapeur sur le fleuve Volga et la mer » Caspienne déclare, par les présentes, que les lampes élec- » triques Edison installées à bord du bateau à vapeur, » **Maréchal Souvaroff**, dans toutes les cabines ainsi que » dans la chambre des machines à vapeur, ont donné une » lumière splendide et qu'on ne peut désirer rien de mieux » sous le rapport de la clarté, de la fixité et d'un confort » bien entendu. »

« St-Pétersbourg, 31 décembre 1882 »

Signé : La Direction.

L'emménagement pour l'éclairage d'un second bateau à vapeur de cette même compagnie, **l'Alexandre II**, est en train d'être achevé.

Espagne.

Madrid. — Nous éclairons à Madrid l'usine de **M. Labrador**, constructeur de machines. L'ingénieur de notre Société, **M. Quatravaux**, qui a fait cette installation, a reçu la visite des principaux fonctionnaires du Ministère de la Marine Espagnole, ainsi que des membres les plus marquants de la presse. Tous les journaux de Madrid ont publié les articles les plus élogieux, et les visiteurs viennent chaque jour en grand nombre étudier cette première application de notre système en Espagne ; nous sommes en pourparlers pour des installations de grande importance, dont plusieurs pour le compte du gouvernement.

15.2

2500 = 5000

237 PARIS. — IMPRIMERIE CHARLES BLOT, RUE BLEUE, 7

N° 5. Paris, 15 Juin 1883.

Compagnie Continentale Edison

SOCIÉTÉ ANONYME AU CAPITAL DE **Un Million** DE FRANCS

PARIS. — 33, Avenue de l'Opéra. — PARIS

ÉCLAIRAGE

PAR STATIONS CENTRALES

DE

VILLES, RUES, ÉDIFICES PUBLICS & PARTICULIERS,

Châteaux, Magasins,

THÉATRES, USINES, MUSÉES, HOPITAUX, CAFÉS, ETC.

CINQUIÈME BULLETIN

Première station centrale de New-York.

La Station Centrale de New-York continue à fonctionner avec un plein succès; depuis neuf mois elle fournit la lumière à ses abonnés, nuit et jour, sans aucune interruption.

Les demandes nouvelles se multiplient de telle sorte que bientôt le chiffre maximum de lampes que cette station peut alimenter sera atteint, et la direction choisit, parmi les nombreux clients qui demandent leur inscription, ceux qui emploieront la lumière pendant le plus grand nombre d'heures par jour.

La dernière liste des abonnés que nous possédions porte la date du 6 avril 1883, et comprend 368 maisons où sont installées 8.117 lampes; parmi ces abonnés nous relevons les noms des principaux banquiers de New-York, des grandes Compagnies d'assurances et des journaux les plus importants ainsi que de nombreux magasins de toute espèce.

Le matériel employé, et qui a été installé sous la direction personnelle de M. Edison, a donné toute satisfaction et a parfaitement résisté aux essais très sévères que M. Edison lui a imposés, nous signalerons entre autres un des moteurs à vapeur Armington et Sims, ayant une vitesse de 360 tours à la minute, que M. Edison a fait marcher *sans aucune interruption* du 10 au 27 mars 1883, soit 17 jours.

En outre ces essais ont permis à M. Edison de réaliser de nombreux perfectionnements dont profiteront de suite les Stations Centrales qui vont être établies en Europe.

Station centrale à Roselle New-Jersey.

La petite ville de Roselle, New-Jersey, est éclairée par une petite Station Centrale, depuis le 10 janvier 1883.

Pour débuter on a installé 650 lampes dont 150 dans les rues; le courant électrique est produit par 3 dynamos K, auxquels un quatrième sera prochainement adjoint.

Comme partout ailleurs la marche, dès le premier jour, a été des plus satisfaisantes, et aucune interruption ne s'est produite dans la distribution de la lumière.

Des stations centrales sont en cours d'exécution dans diverses villes des Etats-Unis; nous en entretiendrons nos lecteurs dans nos prochains bulletins.

Éclairage des navires à vapeur par le système Edison.

Depuis une année une révolution complète s'est produite en Amérique et en Angleterre pour l'éclairage des paquebots et navires de plaisance; les Grandes Compagnies de Navigation et les armateurs ont reconnu la sécurité absolue de l'éclairage électrique par incandescence; ils ont abandonné pour tous leurs navires en construction ou déjà en service les anciens modes d'éclairage qui ont amené si souvent d'épouvantables catastrophes; le jour n'est pas éloigné où personne ne consentira plus à prendre passage sur des navires éclairés par des matières aussi dangereuses que le pétrole ou la bougie.

Déjà les rapports des capitaines de navires signalent les précieux services que leur rend l'éclairage électrique Edison; nous citerons entre autres le rapport du capitaine Whittle, du vapeur Américain « Carolina » abordé entre Norfolk et Baltimore par le vapeur Anglais « Riverdale ». Le capitaine Whittle s'exprime en ces termes :

« Nous avons eu ainsi la démonstration complète des immenses avantages et de la sécurité absolue du système Edi-

son ; en effet les lampes qui ont été brisées dans les parties du navire endommagées par le choc, se sont éteintes par ce seul fait, et ainsi ont été écartés les dangers d'incendie qui se seraient certainement produits si un autre mode d'éclairage avait été employé ; les autres lampes ont continué à fonctionner comme auparavant. »

Les lampes Edison présentent encore pour l'éclairage des navires un autre avantage; en effet, pouvant brûler *sous l'eau*, elles permettent, d'une part, d'explorer la cale d'un navire où une voie d'eau se serait déclarée et qui serait déjà envahie, et, d'autre part, de faire visiter, même pendant la nuit, à l'extérieur, la carène des navires.

Au sujet de l'éclairage sous-marin, nous avons le plaisir d'informer nos lecteurs que l'expédition qui vient d'être envoyée dans les Mers du Sud par le Ministère de la Marine, à bord du **Talisman**, et qui est placée sous la direction scientifique de M. Milne Edwards, a emporté un nombre considérable de lampes Edison, préparées spécialement pour elle, et qui lui permettront de faire, à de grandes profondeurs, des observations d'un genre tout nouveau, qui amèneront certainement des découvertes importantes et du plus grand intérêt pour la science.

Nous n'avons pu nous procurer pour la date de publication de ce bulletin une liste complète des installations d'éclairage Edison existant à bord de navires et qui ont été faites par les Compagnies Edison, américaines, anglaises ou coloniales, mais nous en donnons ci-dessous un aperçu déjà important.

Navires éclairés par la lumière électrique Edison.

NOM	CLASSE	PROPRIÉTAIRES
Namouna	Yacht	Mr James Gordou Bennett.
Carolina	Paquebot	Bay-Line.
Columbia	—	Oregon Railway et Navigation Cᵉ.
Queen of Pacific	—	— —
City of Worcester	—	N. Y. et Norwich Line
Chen-Yuen	Cuirassé	Gouvernement chinois.
Tarawara	Paquebot	Union S. S. Cᵒ of New Zealand.
Waihora	—	— —
Malabar	Transport	Marine royale anglaise.
Rio Pardo	Paquebot	National Brazilian S. S. Cᵒ.
Rio Parana	—	— — —
Apolo	—	Compagnie la Platense.
Minerva	—	— — —
Pateena	—	Tasmanian Steam Navigation Cᵉ.
Clan Macarthur	—	Clan Line.
Clan Mac. Intosh	—	— —
Adelaide	—	
Alexandre II	Vapeur de rivière	Cie « Kaukas Mercure ».
Maréchal Souwaroff	—	—

Parmi les navires actuellement en construction qui seront munis, de l'éclairage électrique Edison nous citerons le **Sirio**, appartenant à une Cie italienne de navigation; l'**Oregon**, de la Cie William Guion, entre Liverpool et New-York, et le **Takapuna** de la Union S. S. Cie of New-Zealand; au sujet de ce dernier navire nous lisons dans les journaux anglais la remarque suivante: « La Union S. S. Cie of New-Zealand » qui a éclairé deux de ses navires au moyen de lampes Swan, et deux autres au moyen du système Edison, a confié l'éclairage de son nouveau paquebot, le *Takapuna*, en construction à Barrow, à la Edison Electric Light Cie. Les mérites respectifs des deux systèmes d'éclairage ayant été ainsi comparés sur 4 navires, la préférence accordée maintenant à la Cie Edison prouve hautement en faveur de son système.

INSTALLATIONS EN EUROPE

France.

Quoique la saison que nous traversons en ce moment soit peu favorable aux installations de lumière électrique, la plupart des industries n'ayant pas besoin d'éclairage pendant ces longues journées, nous avons traité d'importantes affaires depuis la publication de notre bulletin du 15 février dernier, voici les principales :

Paris.

Nous faisons en ce moment à l'entrepôt des vins et alcools du quai Saint-Bernard une installation d'environ 300 lampes A

et B actionnées par un dynamo K ; l'éclairage fonctionnera dans les chais et caves pendant toute la journée; nous pourrons fournir aussi la force motrice dont les entrepositaires ont besoin dans leurs manipulations; nous avons la conviction qu'après cet essai notre éclairage sera adopté dans tous les entrepôts, qui renferment de si grandes quantités d'alcools et d'autres liquides inflammables et sont par suite exposés à des incendies désastreux.

Ivry-sur-Seine.

Une installation de 17 lampes A actionnées par un dynamo E a été faite chez M. Lemoine, maitre de forges à Ivry-sur-Seine, pour l'éclairage de ses bureaux et de divers ateliers.

Bordeaux.

Nous avons installé 88 lampes A, actionnées par un dynamo L, dans l'importante huilerie de Messieurs Maurel et Prom et Maurel frères; cette installation sera portée ultérieurement à 150 lampes, lorsque diverses annexes de l'usine seront terminées.

Essonnes.

Messieurs Darblay et Béranger, propriétaires des vastes et célèbres fabriques de papiers d'Essonnes, nous ont commandé en février dernier une installation de 60 lampes A avec dynamo Z ; ils se sont montrés si satisfaits qu'après quelques jours de marche ils nous ont demandé une deuxième installation d'un même nombre de lampes ; il est probable qu'avant peu l'éclairage Edison sera encore considérablement augmenté dans leurs usines.

Rives.

MM. Blanchet et Kléber, fabricants de papiers photographiques, ont aussi adopté la lumière Edison pour leurs importantes papeteries de Rives (Isère). Nous avons installé chez eux 29 lampes A et 36 B, actionnées par un dynamo Z; ces Messieurs nous ont exprimé toute leur satisfaction et manifestent l'intention d'appliquer notre système à l'éclairage de leurs autres usines.

Voiron.

La papeterie de MM. de Guérimand et Cie, à Voiron (Isère), est éclairée depuis le 26 avril au moyen de 28 lampes B et 3 A, actionnées par un dynamo E; le succès est complet comme partout ailleurs et MM. Guérimand et Cie nous ont transmis leurs félicitations.

On remarquera le développement rapide de notre éclairage dans les papeteries ; la lumière Edison offre en effet des avantages tout particuliers pour ce genre d'industrie, qui demande l'emploi de la lumière pendant toute la nuit ; MM. Blanchet et Kléber estiment à 20,000 francs par an l'économie qu'ils réaliseront dans une seule usine, par suite de la suppression des déchets que causaient les impuretés tombant dans les cuves de pâte à papier et produites par l'emploi du gaz et d'autres modes d'éclairage, brûlant à flamme libre.

En outre, les papeteries disposant en général de forces hydrauliques, l'éclairage de ces établissements par le système Edison ne nécessite comme dépense courante que le remplacement des lampes, soit moins de 0 f. 01 par heure et par lampe, *c'est-à-dire une dépense moindre que celle qu'occasionnerait l'éclairage au gaz payé à raison de 0 f. 05 le mètre cube.*

Roubaix.

Ainsi qu'il était facile de le prévoir notre éclairage réalise chaque jour de nouveaux progrès dans la région si industrielle du Nord.

Nous avons fait à Roubaix, où les usines de MM. Motte et Meillassoux et de M. Louis Lefebvre avaient déjà adopté le système Edison, une nouvelle installation chez MM. Amédée Prouvost et Cie, filateurs de laines, dont l'important peignage est éclairé au moyen de 150 lampes A actionnées par un dynamo L.

Des affaires considérables sont en cours de négociations pour la même ville et les environs.

Montceau-les-Mines.

Une installation des plus intéressantes a été faite au Puits-Magny, appartenant à la Cie des mines de Blanzy. 20 lampes B et 8 A ont été placées dans les salles des machines d'extraction, les bureaux et sous les chevalements des puits ; 2 lampes A placées à 321 mètres de profondeur éclairent deux engagements.

MM. Chagot et Cie, directeurs de la Cie des Mines de Blanzy, attachent une importance toute spéciale à cette expérience qui fait présager l'adoption à bref délai de la lampe Edison pour l'éclairage des galeries de mines ; ainsi se trouveront définitivement écartés les risques d'explosions de grisou, qui, chaque année, causent de si nombreuses victimes parmi les travailleurs des mines.

Annonay.

Nous venons de terminer une installation de 60 lampes A actionnées par un dynamo Z chez M. Jomaron à Annonay. M. Jomaron a adopté la lumière Edison non seulement pour son usine, une mégisserie, mais encore pour sa maison d'ha-

bitation, son jardin, etc.; cette seule installation suffirait donc à démontrer que la lampe à incandescence se prête aux usages les plus variés et remplace partout avantageusement les anciens systèmes d'éclairage.

Eaux-Bonnes.

Un de nos ingénieurs installe en ce moment 17 lampes A, avec un dynamo E à l'Hôtel-de-France, aux Eaux-Bonnes. M. Taverne, le propriétaire de l'hôtel, désirait installer tout d'abord 60 lampes; mais la force motrice dont il dispose n'étant pas suffisante, il fait construire de nouvelles turbines et, dès qu'elles seront en place, l'installation de l'éclairage Edison sera complétée, à la grande satisfaction des baigneurs qui auront partout une lumière ne dégageant aucune chaleur, considération des plus importantes dans les salles à manger ou de bal où se trouvent réunies souvent un si grand nombre de personnes.

Caen.

L'Exposition de Caen qui vient de s'ouvrir le 5 juin est entièrement éclairée par notre système; nous avons installé plus de 300 lampes dans les diverses galeries et sur le cours; cette installation est des plus réussies, et M. le maire de Caen nous en a témoigné toute sa satisfaction. Grâce à notre éclairage, l'Exposition peut rester ouverte la nuit, et la recette journalière se trouve considérablement augmentée.

Nous éclairerons également l'Hôtel-de-Ville de Caen, pendant les bals donnés par M. le maire à l'occasion de l'Exposition.

Angoulême.

A l'occasion du concours de gymnastique qui a eu lieu à Angoulême le 13 et le 14 mai, nos représentants dans la

Charente, MM. A. Laprérie, Alexandre Laroche-Joubert et Cie ont installé dans les salles de banquet et de bal de l'Hôtel-de-Ville, ainsi que dans des cafés avoisinants 120 lampes A actionnées par 2 dynamos Z.

Cet éclairage a été vivement admiré par tous les assistants, et tous les journaux en ont parlé dans les termes les plus flatteurs, M. le maire d'Angoulême a bien voulu féliciter MM. A. Laprérie, Alexandre-Laroche-Joubert et Cie de la manière la plus vive pour le concours apporté par eux à la réussite des fêtes.

Cognac.

La parfaite réussite de notre éclairage à Angoulême, coïncidant avec la crise qui s'est produite à Cognac entre les consommateurs de gaz et la compagnie du Gaz de cette ville a amené la conclusion rapide de plusieurs affaires.

Depuis le 20 mai dernier le café du Châlet à Cognac est éclairé par 17 de nos lampes avec un dynamo E; en outre, M. Gravelles, de cette ville, nous a acheté une installation de 60 lampes A avec dynamo Z, qui va être établie dans une distillerie.

Aire-sur-l'Adour.

Du 26 au 29 mai dernier, nous avons éclairé les Arènes d'Aire-sur-l'Adour (Landes), pendant les fêtes qui y ont eu lieu; notre lumière était encore inconnue dans cette région et les nombreux visiteurs venus des villes environnantes ont été vivement intéressés; les fêtes de nuit ont été plus animées que jamais auparavant et comme partout, nos ingénieurs ont reçu les félicitations de tous les assistants.

Un des principaux journaux de Bordeaux apprécie comme suit cette installation :

« Aire-sur-Adour. — Des renseignements nous parviennent sur les expériences de lumière électrique qui ont eu lieu à Aire-sur-Adour les samedi, dimanche, lundi et mardi derniers.

Les lampes Edison ont merveilleusement fonctionné pendant toute la soirée jusqu'à deux heures du matin; pas une seule intermittence de lumière ne s'est produite et pendant près de six heures les 250 lampes Edison ont jeté sur la ville d'Aire une clarté éblouissante.

On nous assure qu'à la suite de ces expériences si concluantes, plusieurs villes de notre région sont entrées en pourparlers avec la société Edison pour leur éclairage au moyen de ce système ingénieux. »

Espagne

Dans notre bulletin du 15 février, nous annoncions que nous étions en pourparlers avec le gouvernement Espagnol, pour des installations de grande importance. Ces pourparlers ont déjà abouti pour une installation, celle de **l'Arsenal de la Carraca**, qui a reçu l'approbation du Conseil d'Etat. Notre représentant vient de signer avec M. le ministre de la Marine Espagnole un contrat pour l'éclairage de cet important arsenal, où nous installerons 171 lampes A et 250 B actionnées par 2 dynamos L. Nous décrirons en détail dans un prochain bulletin cette installation.

Nos lecteurs n'ont pas oublié que l'année dernière nous avons fait l'installation de la Poudrerie de Saint-Chamas, appartenant au gouvernement Français, et de l'arsenal de Dantzig, de l'Amirauté Allemande. Tous les gouvernements adoptent donc l'éclairage Edison, pour les établissements où sont accumulées des matières explosibles et inflammables; c'est la meilleure preuve de la sécurité qu'il donne.

Allemagne

Strasbourg. — Nos lecteurs savent qu'une installation type Z fonctionne à la gare de Strasbourg depuis le com-

mencement du mois de janvier 1882. C'était la première installation que notre Société a faite en Europe. Elle comprenait 50 lampes A et 55 lampes B. Nous recevons à ce sujet les informations suivantes :

La dernière lampe (du type B) de la première pose vient d'être mise hors de service après avoir atteint la durée de 5.800 heures. Cette lampe était conservée comme un véritable trésor par les agents de la Direction et, si pendant un an ses rayons lumineux avaient éclairé le public, les personnes privilégiées étaient à la fin seules admises à la voir.

Beaucoup d'autres lampes ont également montré une très longue durée : 1.800 à 3.500 heures environ ; la moyenne générale est de 950 heures. L'inspecteur, chargé du service d'éclairage, a fait une série d'expériences sur la lampe de 5.800 heures ; ses observations seront communiquées au monde scientifique. Nous recevrons une copie authentique de ce rapport et la direction de Strasbourg se propose d'envoyer une autre copie, avec la lampe, directement à M. Edison.

La machine dynamo (N° 32) employée pour cette installation, a fonctionné dix heures par jour en moyenne depuis janvier 1882. Sa marche a toujours été parfaite et n'a jamais occasionné aucune interruption d'éclairage. Une série de 40 essais ont été faits sur cette machine et tous ont été trouvés très satisfaisants. Ces résultats seront livrés à la publicité en même temps que le rapport sur les lampes. Après un succès pareil il n'est que naturel que nous ayons été chargés par la Direction Impériale des chemins de fer en Alsace-Lorraine d'installer la lumière Edison dans la nouvelle gare centrale de Strasbourg qui sera inaugurée vers la fin de ce mois. Les travaux sont très avancés, nous installons en ce moment près de 1.300 lampes, mais ce nombre sera sensiblement augmenté lorsque toutes les constructions de la nouvelle gare seront terminées et mises en service.

Munich. — Le théâtre de la cour (Residenztheater), est maintenant éclairé tous les soirs par les lampes Edison. Nous

avons donné les détails de cette installation dans le bulletin spécial (N° 4) publié au mois d'avril et qui était exclusivement consacré à l'éclairage électrique des théâtres. Nous nous bornons donc ici à constater que cet éclairage a satisfait à ce point la direction et le public, qu'il a été décidé à éclairer également, par le système Edison, le grand théâtre national de Munich, un des plus beaux et des plus importants de l'Allemagne.

Les travaux de cette installation ont été dirigés par M. Seubel, ingénieur de notre société. Ce monsieur a été engagé depuis par notre société allemande et dirigera tous les travaux au sud de l'Allemagne.

Berlin. — Le nouveau théâtre allemand (Deutsches Theater), sera éclairé par nos lampes. Le contrat entre la Direction et la Société allemande Edison est signé.

Berlin. — Les salles du restaurant de l'Exposition hygiénique sont éclairées par 250 lampes A ; le public et la presse sont unanimes à trouver incomparable cette lumière si douce et si agréable et qui ne développe pas la moindre chaleur.

Cologne. — Nous avons déjà mentionné dans un de nos bulletins précédents l'installation qui fonctionne dans les bureaux de la rédaction et dans l'imprimerie de la « Gazette de Cologne ». Il y a dans la salle de composition 124 lampes B et 8 lampes A ; dans les ateliers de reliure 10 lampes B ; dans les bureaux 9 lampes A et 20 lampes B ; dans la stéréotypie 6 lampes A et dans la chambre des machines 2 lampes A et 2 lampes B donc 181 lampes. L'éclairage fonctionne depuis le mois de juillet 1882 d'une manière absolument satisfaisante. Cette installation a été montée sous la direction de M. Pfankuch, électricien émérite de Cologne et dans la maison duquel l'éclairage Edison fonctionne depuis longtemps.

Neuwied. — Fabrique de tabacs de M. Joh. Pet. Schneider. Le nombre actuel des lampes (28 B) sera augmenté dans le courant de cet été. M. Schneider est très satisfait de l'éclai-

rage qui fonctionne régulièrement depuis le mois d'octobre 1882.

Kreuznach. — Fabrique de cuir de M. Geo Andres, (70 lampes), éclairée par notre système depuis le mois de septembre; fonctionnement parfait.

Crefeld. — Une petite installation de 47 lampes (A et B) éclaire une partie de la teinturerie de M. H. O. Neuhaus succ., depuis le mois d'octobre, et tout le monde est enchanté de la lumière qui, ne modifiant aucunement les couleurs, rend aux ouvriers leur besogne aussi facile qu'en plein jour.

Werden. — Le Journal de Dortmund dit au sujet d'une installation de 34 lampes B qui y fonctionne depuis plus de six mois :

« La fabrique de machines à coudre C. Dürrkopp et Cie à » Werden vient d'installer à titre d'essai dans la partie nou- » vellement construite de l'établissement l'éclairage électrique » Edison et ces essais ont donné des résultats si satisfaisants, » qu'on va éclairer sous peu toute la fabrique par le même » système; 34 lampes à incandescence Edison du type B » sont actionnées par une petite machine dynamo-électrique. » Les lampes sont disposées sur les différentes machines » absolument comme les becs de gaz. La couleur de la lu- » mière est fort douce et agréable.

Ces trois dernières installations ont également été montées sous la direction de M. Pfankuch de la maison Pfankuch et Reinhardt de Cologne.

Munich. — Une installation de 40 lampes A et 40 lampes B fonctionne dans la brasserie de la Croix d'or de cette ville depuis plus de six mois. L'éclairage dure régulièrement tous les jours depuis 6 heures du soir jusqu'à 2 heures du matin. L'absence complète de chaleur et la lumière si douce enchantent le public.

Nous citons parmi les autres installations fonctionnant en Allemagne les suivantes :

Berlin. — Ressource de 1794 (cercle)	1	dynamo	Z
Rositz. — Fabrique de sucre	1	—	K
Berlin. — Spicker et Cie.	1	—	Z
Berlin. — Rosenfeld et Cie.	1	—	Z
Coepnik. — Dannenbaum frères.	1	—	Z
Cöswig. — Fabrique de papier.	1	—	Z
Berlin. — Usine à gaz.	1	—	Z

Belgique.

Bruxelles. — L'éclairage à la chambre des députés nous a valu le certificat officiel suivant :

CHAMBRE DES REPRÉSENTANTS — Bruxelles, le 19 mars 1883.

QUESTURE

« Je soussigné, G. Washer, Membre et Questeur de la Chambre des Représentants, certifie que les essais de l'éclairage établi dans la salle des séances de la Chambre des Représentants, par les soins du Crédit Général représentant en Belgique la Compagnie Continentale Électrique Edison de Paris, au moyen de lampes à incandescence Edison, ont pleinement réussi et que le dit éclairage n'a rien laissé à désirer au point de vue de la fixité de la lumière et du peu de développement de la chaleur.

Ces essais ont eu lieu du 23 janvier au 9 mars 1883. »

Signé : G. Washer.

Bruxelles. — Le théâtre du Parc vient de clôturer. Notre éclairage a fonctionné jusqu'à la fin de la saison et à

la grande satisfaction du public aussi bien que du directeur et des artistes. Une partie du matériel sert en ce moment pour l'éclairage du théâtre du Musée du Nord qui ne pouvait donner que des matinées jusqu'à présent, parce que la ville n'autorisait pas de l'éclairer au gaz à cause des dangers d'incendie; notre système excluant toute crainte de ce genre, la municipalité a immédiatement donné l'autorisation nécessaire et nos lampes y fonctionnent déjà depuis un mois.

Bruxelles. — Nous avions demandé il y a quelque temps au collège municipal de cette ville l'autorisation d'y créer une station centrale de 5000 lampes qui ne fut pas accordée parce que les autorités trouvaient que les expériences et les essais faits en Belgique n'étaient pas encore suffisamment concluants. Or, après la réussite et le grand succès de notre éclairage au Théâtre Royal du Parc, la ville est entrée en pourparlers et nous espérons recevoir dans très peu de temps la concession pour une station centrale de dix mille lampes qui desservira, en dehors des théâtres, les cafés, les restaurants et les maisons particulières avoisinants.

Hollande.

Notre prochain bulletin donnera à nos lecteurs des nouvelles sur l'inauguration de la station centrale de Rotterdam, qui aura lieu vers la fin de ce mois. La station centrale d'Amsterdam suivra au mois prochain; les travaux sont déjà très avancés. Parmi les installations isolées, nous nous bornons de citer les plus importantes, nous n'aurions, du reste, qu'à répéter encore une fois tout le bien que nous avons dit de nos autres installations. Depuis notre première installation (celle de la gare de Strasbourg) jusqu'à ce jour, nous n'avons eu jamais aucun mécompte à enregistrer. Il y a en ce moment plus de deux cents installations dont plusieurs très importantes, et toutes, sans aucune exception, ont fonctionné depuis la mise en marche d'une façon absolument satisfaisante.

Voici la liste des installations les plus importantes de la Hollande :

Amsterdam. — Sucrerie dite de Wester-Suikerraffinadery (environ 500 lampes).

d°. — Raffinerie Spokler et Tetterode.

d°. — Brasserie Peters-Kroy et Cie.

Rotterdam. — Imprimerie du Journal « Nieuwe Rotterdam'sche Courant. »

Groningen : Tissage Schosnebaum.

Amsterdam : Minoterie « de Weichsel ».

Notre Société Hollandaise prépare des installations pour :

Amsterdam : Le Journal « Handelsblad ».

d° Le cercle « Leesmuseum ».

et pour plusieurs théâtres et industriels.

Autriche-Hongrie.

Vienne (Autriche). — Nous sommes occupés en ce moment à préparer le matériel pour l'Exposition Internationale d'Électricité, qui s'ouvrira à Vienne au mois d'août. Notre exposition se composera de 1 dynamo K, 1 dynamo L et 1 dynamo Z actionnant près de 500 lampes A. Nous exposerons en même temps un moteur à vapeur de grande vitesse de MM. Armington et Sims à Providence.

Trieste. — Le gouvernement autrichien va faire des essais avec notre système à bord d'un vaisseau de guerre. Nous construisons un dynamo spécial du type L, qui sera actionné par un moteur Brotherhood. L'éclairage comprendra 150 lampes A.

Prague. — Le grand théâtre national actuellement en construction à Prague, capitale de la Bohême, sera éclairé entièrement par nos lampes. On y installera 7 dynamos K et 1 dynamo Z qui actionneront près de 2000 lampes. Nous

[ITEM FOUND IN BOOK]

	Inclination to the Ecliptic	Eccentricity	Perihelion Date	Aphelion Date	Cir. of the planet [illegible]
	7° 0'	.20560478			
	3° 23'	.00684311 .00684331			
	0° 0' 0"	.01677120 .01677110	July	Jan.	July
	1° 51'	.09326113	August 27th	Feb. or Mar.	13200 mi
	1° 19'	.0482519	Jan		276460 ..
	2° 30'	.0560470 .0559428			
	2° 29'	.0463592	4		235620 "
	0° 46'	.0089903			
	1° 46'				

reviendrons sur cette installation importante après l'inauguration de l'éclairage.

Parmi les installations commandées, mais qui ne sont pas encore tout à fait montées, nous mentionnons celles de

Vienne. — Tageblatt (journal le plus répandu de l'Autriche).

Rohatetz. — La grande Sucrerie de M. Auspitzer.

Kremsier. — Hanna Malz Fabrik (fabrique de Malte),

Russie.

Moscou. — Notre système a contribué largement à la réussite des fêtes données à l'occasion du couronnement du Tzar à Moscou. Le Kremlin était illuminé par 3,500 de nos lampes et l'effet que produisait cet éclairage a enthousiasmé tout le monde. Le *Hérault de Saint-Pétersburg* (*Saint-Pétersburg Herold*), publie le rapport suivant :

« L'illumination qui avait lieu le jour du couronnement » attirait dans les rues toute la population de Moscou et » surtout dans la proximité du Kremlin. Tout le monde » voulait voir l'illumination dont on avait tant lu et tant » parlé pendant des semaines et qui devait surpasser tout » ce qu'on avait vu jusqu'à ce jour ; et en effet cette illu- » mination offrait un aspect grandiose et incomparable. Les » trois tours de Iwan Weliskij brillaient d'une manière » féerique. L'intensité de la lumière, la tranquillité absolue » qu'on ne peut jamais obtenir avec un autre mode » d'éclairage, tout contribuait à nous faire penser aux palais » des fées dont nous gardons un vague souvenir de notre » enfance. »

Le journal *Nowe Wreme* dit :

« Iwan le Grand tout illuminé par les lampes électriques Edison présentait un aspect vraiment magique. »

Italie.

Milan. — La station centrale sera prête à fonctionner avant la fin du mois de juin. La Société italienne Edison a acheté le théâtre Santa-Radegonda et y a installé l'usine centrale. L'installation comprendra 12 dynamos C pouvant actionner 12,000 lampes A. On commencera par 4 dynamos (4,800 lampes A) actionnés par 2 moteurs Armington et 2 moteurs Portér-Allen qui sont installés dans le sous-sol pour éviter les secousses. En face de ces quatre dynamos se trouvent 1,200 lampes A qui servent pour les essais des machines. Tout autour sont placés les conducteurs, reliant les dynamos aux câbles extérieurs d'une longueur totale de 4,000 mètres environ. Ce travail a été exécuté par M. Patterson, ingénieur de New-York et les essais ont été des plus satisfaisants. Le montage des dynamos a été exécuté par M. Hennis, La direction de la station centrale pour tout ce qui regarde le matériel électrique est confiée à M. Lieb. Au rez-de-chaussée sont placées deux batteries de chaudières représentant une force de 750 chevaux-vapeur environ, fournies par la maison Babcock et Wilcox de New-York et Glasgow. Les chaudières sont desservies par une cheminée en maçonnerie de 52 mètres de hauteur. Au premier étage enfin se trouvent installés la chambre des expériences et le magasin du matériel.

Tous les établissements principaux du centre de la ville de Milan seront éclairés par cette station. Nous citons entre autres le théâtre Manzoni qui sera inauguré prochainement avec le nouveau système d'éclairage. La presse et l'opinion publique demandent que le Grand Théâtre de la Scala soit aussi éclairé par la station. Cette énorme installation qui demande 2,000 lampes A pour l'éclairage ordinaire et 2,700 pour des cas extraordinaires pourra probablement être achevée pour l'hiver prochain. La station centrale pourra commencer à fonctionner le mois courant; mais il faudra un certain temps avant que tous les dynamos puissent être employés, et cela à cause du temps que nécessite le montage des fils dans les

maisons et établissements particuliers. En attendant le fonctionnement de la grande station centrale, le Comité italien en a installé depuis le mois de novembre dernier une plus petite sur la place du Dôme. Cette installation de 150 lampes environ éclaire les magasins de MM. Thonet frères, Monti et Nava, Andone Calderoni, Félix Laforêt, A. Franceschi, Pietro Cassioni et Fortunato Finzi. L'éclairage se fait régulièrement depuis sept mois, sans qu'il y ait eu la moindre interruption et quoiqu'il n'y ait pas de machine de réserve. Dans le premier mois de cette installation, nous avons aussi éclairé le nouveau portico, en substituant au grand bec de gaz une couronne de 8 lampes A. L'effet en a été des plus heureux et la presse a demandé à l'unanimité que l'éclairage électrique soit appliqué à tout le portico et à la galerie. La ville de Milan nous a déjà demandé un devis complet pour cet éclairage que nous comptons établir aussitôt que les travaux de la station seront terminés.

Aux installations isolées, mentionnées dans le dernier bulletin, nous pouvons ajouter les suivantes déjà en fonctionnement.

Sampierdarena. — Scerno Gismondi et Cie, Huilerie, 15 lampes A

Pordenone. — A. Ammau et Wepfer, filature de coton, 60 lampes A.

Gênes. — Voilà une lettre adressée au Comité italien, par MM. Cassanello Flli fu Pietro :

Gênes, le 30 novembre 1882.

« Il y a presque deux mois que nous nous servons de la « lumière Edison dans notre moulin de Pegli et nous nous « empressons de vous déclarer que nous en sommes très satis- « faits. La lumière est fixe, intense et limpide. La force « nécessaire pour la machine est très petite et même infé- « rieure à celle que vous nous aviez indiquée. Enfin nous « croyons que la lumière Edison est supérieure à tous les

« autres systèmes d'éclairage que nous connaissons et nous « n'aurons aucune difficulté à le faire constater par tous « ceux qui voudront bien visiter notre établissement.

« Signé : Fratelli Cassanello fu Pietro. »

Puis nous sommes en train de monter en ce moment les installations suivantes :

Livourne. — Auguste Traxler, Villa, 15 lampes A.

Gênes. — *Sirio*, steamer de la Société Reggio et Cie, 150 lampes A.

Vaprio. — Benigno Crespi, filature de coton, 150 lampes A. M. Crespi a déjà dans son établissement une installation de 60 lampes A, fonctionnant depuis un an. Les résultats obtenus l'ayant parfaitement convaincu des nombreux avantages de notre système d'éclairage, il nous a commandé une nouvelle installation de 150 lampes.

Pise. — M. Giacomo Nissim, après avoir essayé pendant huit mois notre système avec une installation de 60 lampes, vient de nous en commander une de 250. Nous communiquons à nos lecteurs le certificat suivant de cette maison :

Pise, le 28 octobre 1882.

« Je, soussigné, déclare que depuis plusieurs semaines « fonctionnent dans mon établissement pour la production « mécanique de tissus à couleur, une machine dynamo-élec- « trique et 60 lampes à incandescence, qui m'ont été four- « nies par le Comité pour les applications de l'Electricité, « système Edison, en Italie, et j'en suis pleinement satisfait « sous tous les rapports.

« Signé : pp. Giacomo Nissim.

« Alexandre Nissim. »

Deux autres installations de 15 lampes A seront montées prochainement.

Tenzanico (Lecco). — La filature de soie de M. Monti.

Teduccio (Naples). — Le moulin à vapeur de MM. Wegnan, Bodmer et Cie, S. Giovanni.

Nous avons enfin des pourparlers très avancés avec de très nombreux établissements industriels parmi lesquels nous pouvons citer :

Venise. — Le nouveau Cotonificio Veneziano (300 lampes A).

Castelnuovo. — Le nouvel établissement de MM. Crespi et Ce (60 lampes A).

Assa-Como. — La filature mécanique de M. Antonio Oltolino, etc.

Nous mentionnons encore que 400 lampes Edison sont installées au bord du cuirassé *Dandolo*, de la marine royale italienne et que la durée moyenne de ces 400 lampes est actuellement de 1575 heures. Ce résultat a amené une décision du Comité des constructions navales en Italie, qui, prévoyant l'installation générale de nos lampes à bord des bateaux de l'Etat, prescrit les mesures à prendre pour réserver lors de nouvelles constructions l'emplacement nécessaire à l'installation des machines.

946 PARIS. — IMPRIMERIE CHAIX?? BLOT, RUE BLEUE, 7.

Societe Electrique Edison

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1. "La Lumiere Edison" (1884)
2. "Liste des Etablissements Eclaires par les Lampes Edison" (1885)

LA

LUMIÈRE EDISON

SYSTÈME D'ÉCLAIRAGE ÉLECTRIQUE

TRANSMISSION
DE LA FORCE MOTRICE A DOMICILE

DIXIÈME ÉDITION

PARIS
IMPRIMERIE ET LIBRAIRIE CENTRALES DES CHEMINS DE FER
IMPRIMERIE CHAIX
SOCIÉTÉ ANONYME AU CAPITAL DE SIX MI
rue Bergère, 20
1884

LA LUMIÈRE EDISON

CHAPITRE PREMIER

LE SYSTÈME EDISON

But d'Edison. — Divisibilité de la lumière. — Foyers de 1, 2 et 4 carcels. — Production en grand de l'électricité dans des stations centrales. — Usine de New-York. — Distribution de l'électricité. — Supériorité de la lumière Edison sur l'éclairage au gaz. — Elle est destinée à le remplacer. — Applications spéciales à la lumière électrique. — Transport de la force motrice à domicile.

En commençant ses recherches sur la lumière électrique, Edison s'est immédiatement posé le problème suivant :

Créer un système complet d'éclairage par l'électricité, qui puisse se substituer purement et simplement au système actuellement en usage de l'éclairage par le gaz. Réunir, par conséquent, tous les avantages que présente le gaz à ceux que peut procurer l'emploi de l'électricité.

L'Exposition de 1881 a montré, au monde étonné des savants et des industriels, qu'il avait suffi de deux années à Edison pour remplir entièrement son gigantesque programme, et pour vaincre une à une les innombrables difficultés qui avaient surgi sur son chemin.

Nous avons dit que dans la pensée d'Edison la lumière électrique qu'il cherchait à réaliser était destinée à remplacer le gaz en toutes circonstances.

Voyons quelles conditions elle allait avoir à remplir.

La première question qui se présentait, celle que beaucoup de personnes, et des plus compétentes, avaient *a priori* déclarée irréalisable, était de produire des foyers suffisamment faibles pour ne pas blesser la vue.

Les lampes électriques les plus modérées que l'on eût obtenues jusqu'alors, possédaient encore un éclat insoutenable qui en limitait l'usage à quelques applications en nombre très restreint. On ne pouvait guère éclairer que des chantiers, des places publiques, ou des espaces fermés d'une grandeur exceptionnelle, tels que cirques, hippodromes, salles d'exposition.

Encore ne parvenait-on à ce résultat qu'à grand

renfort de globes dépolis qui, en absorbant des quantités considérables de lumière, augmentaient notablement le prix de revient.

Quant à l'éclairage domestique il n'y fallait pas songer. La plus forte intensité que l'œil puisse supporter sans fatigue est évaluée à 16 bougies anglaises (1,72 carcels), et la lumière voltaïque tamisée par le verre dépoli ne descendait pas au-dessous de 25 à 30 carcels.

Edison prit comme base de ses recherches cette intensité de 16 bougies, qui est aussi celle des forts becs de gaz, et il ne se tint pour satisfait qu'après avoir obtenu une lampe électrique donnant précisément cette quantité de lumière. Elle est connue sous le nom de lampe A.

C'était déjà un immense progrès. Mais une lumière qui avait la prétention de se substituer au gaz en tout et pour tout, ne devait pas se borner à remplacer les gros becs. Il fallait une lampe plus faible de moitié, qui pût jouer le rôle des petits becs d'appartements. Aussi Edison créa-t-il le type de 8 bougies, ou lampe B (0,75 à 1 carcel).

Alors se passa un phénomène curieux. Les mêmes personnes qui avaient dénigré le plus

chaleureusement les arcs voltaïques parce que ceux-ci produisaient trop de lumière, se mirent à combattre avec non moins de conviction les lampes à incandescence, parce qu'elles n'en donnaient pas assez !

Elles oubliaient que les lampes à incandescence sont destinées à remplacer, non pas les arcs voltaïques, pour l'éclairage des grands espaces, mais bien, nous le répétons, les becs de gaz, les lampes domestiques, voire même les bougies pour l'éclairage des appartements, des bureaux, des théâtres et d'une manière générale, des salles de dimensions courantes.

Du reste le reproche d'être trop faibles, que quelques personnes ont parfois adressé aux foyers incandescents, est parmi les moins heureux qu'elles aient pu imaginer, attendu qu'on est maître de leur donner telle intensité que l'on voudra. Nous verrons dans le chapitre suivant les types auxquels on s'est arrêté.

De ce qui précède, il reste acquis qu'Edison a réalisé des foyers électriques équivalents en intensité à ceux obtenus par le gaz.

Pour les faire fonctionner il faut une machine électrique qui produise le courant voulu, et un moteur qui actionne la machine électrique.

S'il fallait avoir un moteur dans chaque immeuble à éclairer, la question ne serait pas plus avancée que ne le serait celle du gaz, s'il avait fallu une petite usine dans chaque maison. Aussi Edison aborda-t-il tout de suite le problème suivant : produire l'électricité dans des usines centrales, et la transporter au lieu de consommation au moyen d'une canalisation souterraine comme celle du gaz.

Supposons que nous voulions éclairer toute une ville au moyen de l'électricité. Nous la diviserons en un certain nombre d'arrondissements, dont l'étendue sera fixée d'après la consommation probable, et dans chacun desquels nous établirons une usine centrale.

Prenons comme exemple d'usine celle qui fonctionne depuis le mois de septembre 1882 dans Pearl street, à New-York et dont le plan d'ensemble qui a été arrêté par Edison pour l'éclairage du quartier entre Wall street, la grande artère commerciale de New-York, et le quai du Sud fait face au port; ce quadrilatère a environ 1 kilomètre carré de superficie. Vers le centre du quartier se trouve la station centrale dont nous voulons parler. On y a groupé 12 chaudières capables de fournir la vapeur

nécessaire pour faire marcher 12 machines électriques du type de 1,200 lampes. Cela représente une force d'environ 1,500 chevaux alimentant 14,400 lampes A, ou 28,800 lampes B.

De l'usine centrale rayonnent en tous sens de gros conducteurs en cuivre appelés conducteurs principaux, qui se bifurquent à droite et à gauche comme des conduites d'eau et de gaz, pour longer toutes les rues. On peut les poser avantageusement dans les égouts. La maison de chaque abonné est reliée aux conducteurs principaux par une conduite dite conduite d'immeuble, dont la grosseur est proportionnée aux besoins de la maison.

Cette conduite aboutit à un compteur, que l'on place par exemple dans le sous-sol comme un compteur à gaz. Il mesure la quantité exacte d'électricité consommée pendant le mois ou le trimestre écoulé.

Du compteur partent des fils qui sillonnent la maison en tous sens. Ce sont de simples fils semblables à ceux des sonnettes électriques d'appartement. Il est aisé de les dissimuler et la pose s'en fait avec la plus grande facilité, sans endommager les murs ni les tentures.

La lumière électrique présente sur le gaz des

avantages très sérieux, tant au point de vue de la santé que du bien-être.

Un bec de gaz, on le sait, absorbe autant d'oxygène que deux personnes, puis, outre les flots d'acide carbonique et d'oxyde de carbone, ce poison violent qu'il déverse dans l'atmosphère, il apporte tous les gaz délétères qui proviennent des impuretés de la houille; il répand ainsi des quantités considérables d'acide sulfureux, un gaz qui salit les murs, noircit les peintures, et auquel quelques années ont suffi pour faire disparaître les superbes plafonds et panneaux de Baudry, au foyer de l'Opéra.

Un autre inconvénient du gaz dont nous souffrons cruellement, surtout en été, c'est l'énorme quantité de chaleur qu'il dégage. Or, c'est principalement dans les locaux tels que les salles de bals, de spectacles, de conférences, où se trouvent réunies un grand nombre de personnes, et dont la ventilation est par suite plus difficile, que l'on accumule les foyers lumineux. Ceux-ci accélèrent d'une manière effrayante la décomposition de l'air et produisent une chaleur souvent intolérable.

Avec la lampe Edison tous ces inconvénients disparaissent. Elle n'emprunte rien à l'atmosphère et ne lui cède rien. Elle dégage douze fois moins

de chaleur que le gaz, n'influe pas sensiblement sur la température, et tout en donnant une lumière douce, fixe et limpide comme celle du soleil, elle conserve à l'air toute sa pureté et toute sa fraîcheur. Aussi est-il universellement reconnu aujourd'hui que la lumière électrique présente des avantages inappréciables sur le gaz. Il est donc hors de doute qu'elle est appelée à le supplanter complètement dans un avenir plus ou moins éloigné, pourvu que son prix de revient ne soit pas trop élevé.

A ce sujet l'épreuve en grand tentée à New-York est des plus intéressantes, des plus instructives et des plus concluantes, car on a créé depuis de nouvelles stations centrales dans différentes villes des États-Unis.

L'exemple aussi ne pouvait manquer d'être suivi en Europe et nous avons vu s'établir à Milan, d'abord, une station centrale de 4,000 foyers qui éclairent un grand nombre de particuliers et plusieurs théâtres, entre autres celui de la Scala.

Puis d'autres stations se sont élevées à Amsterdam, Rotterdam et Bruxelles.

Nous avons vu que la lumière Edison pouvait se substituer avantageusement à l'éclairage par le gaz, partout où celui-ci est en usage ; mais il

est des applications fort intéressantes qui sont spéciales à la lumière électrique ; telles que les mines, les tissages et les bateaux à vapeur.

On sait que le gaz ne peut guère être employé dans les tissages à cause des dangers d'incendie qu'il présente, et surtout parce qu'il change les couleurs. Ces deux inconvénients majeurs sont absolument écartés par la lampe Edison ; aussi en a-t-on fait usage avec le plus grand succès dans d'importants tissages à Lille, Roubaix, Tourcoing, etc.

Enfin la lampe Edison est appelée à rendre les plus grands services à la marine. Elle fonctionne actuellement sur un grand nombre de vapeurs.

On apprécie beaucoup à bord cette lumière fine et douce, qui n'a pas besoin d'être allumée, mouchée, surveillée constamment, comme les quinquets employés jusqu'alors ; cette lumière qu'aucun vent n'éteint, qui ne vicie pas l'air des étroites cabines du vaisseau, et qui brûle même sous l'eau. Cette dernière qualité a permis de l'employer pour visiter l'hélice, le gouvernail et la coque du navire.

CHAPITRE II

LA LAMPE

La lampe. — Les douilles. — Les commutateurs. — Lustres et appliques. — Lampes portatives. — Lampes à genouillère.

La lampe Edison (fig. 2) se compose d'un filament de bambou carbonisé porté à l'incandescence par le passage d'un courant électrique. Il est placé à l'intérieur d'un globe de verre ayant la forme et la grosseur d'une poire ordinaire, et dans lequel on a fait le vide. Le petit appendice qui surmonte le globe est la fermeture de l'orifice par lequel on a effectué le vide.

Le col de la lampe est hermétiquement fermé au moyen d'une sorte de bouchon en verre soudé avec lui, qui fait saillie à l'intérieur de la lampe.

Le bouchon n'est autre qu'un tube fermé à l'une de ses extrémités (celle qui pénètre dans la lampe) et muni d'un bourrelet à l'autre. C'est sur ce bourrelet que vient se souder la paroi

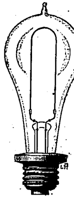

Fig. 2. — La lampe.

circulaire de la lampe. Le bout fermé du bouchon est traversé par deux fils de platine isolés l'un de l'autre et emprisonnés dans la masse du verre au moment de la fermeture du tube. La

traversée du verre est un des points délicats de la lampe. Les changements de température tendent à faire jouer les fils et à pratiquer des passages à l'air. C'est pourquoi on emploie des fils de platine dont le coefficient de dilatation se rapproche très sensiblement de celui du verre.

Le filament de charbon est fixé aux fils de platine au moyen d'un dépôt galvanique de cuivre. Pour éviter que la température ne s'élève trop à l'endroit des soudures, ce qui pourrait amener la fusion du cuivre, le charbon présente à ses extrémités un élargissement, dont le but est de diminuer en ces points la résistance au courant.

Les fils de platine sont reliés par leurs bouts libres à deux armatures en cuivre isolées l'une de l'autre, et scellées dans un tampon en plâtre qui forme le socle de la lampe.

Le vide dans le globe sert à assurer la durée du filament de charbon qui, s'il s'échauffait à l'air, brûlerait en quelques instants. La lampe serait immédiatement hors d'usage, tandis que l'incandescence dans le vide, en empêchant la combustion du charbon, assure aux lampes Edison une durée de sept à huit mois, équivalente à une durée moyenne de 800 heures d'éclairage.

En même temps elle donne à la lumière cette couleur dorée agréable aux yeux, si différente de la lumière blanche de l'arc voltaïque ou des lampes à incandescence à l'air libre. Quand une lampe est hors de service, il suffit de la dévisser et d'en replacer une neuve dans la douille. Ceci s'effectue avec la plus grande facilité : un enfant même peut s'en charger.

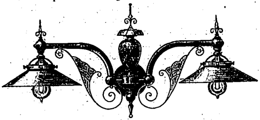

Fig. 3. — Applique double.

La simplicité d'attache des lampes permet de les employer sous toutes les formes en usage pour le gaz (fig. 3, 4, 5). On peut donc les disposer sur des appliques des lustres, et même sur des chandeliers portatifs. En outre les lampes à incandescence se prêtent beaucoup mieux à l'ornementation que le gaz ou les bougies, car elles brûlent dans

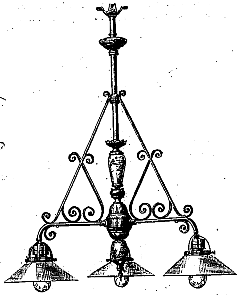

Fig. 4. — Suspension à trois lampes.

tous les sens. La lumière y est aussi utilisée d'une façon plus avantageuse puisqu'on peut la

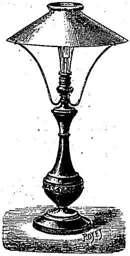

Fig. 5. — Lampe portative.

diriger au moyen de réflecteurs sur tels points que l'on voudra. C'est une qualité précieuse pour

éclairer le travail des ouvriers. Dans les lustres on pourra mettre la lampe la tête en bas, toute la lumière sera réfléchie vers le sol sans projeter aucune ombre.

Les lustres sont munis d'un commutateur général jouant le rôle des robinets à gaz à grande section et permettant d'allumer ou d'éteindre toutes les lampes à la fois; ce qui n'empêche pas chaque bec d'être pourvu de son petit commutateur particulier.

Pour satisfaire à certaines exigences spéciales, comme celles des théâtres par exemple, où il est nécessaire de pouvoir affaiblir ou augmenter à volonté l'intensité d'un groupe de becs, on emploie un rhéostat analogue au régulateur de la machine dont nous donnons la description plus loin. Les jeux de lumière sont ainsi obtenus avec la même facilité qu'au moyen du gaz.

CHAPITRE III

LA CANALISATION

Conducteurs. — Boîtes de jonction. — Coupe-circuits

Le transport de l'électricité servant à la production de la lumière s'effectue au moyen de conducteurs en cuivre.

Pour de faibles quantités, de simples fils suffisent; mais, au cas qui nous occupe de l'éclairage de tout un quartier, il faut de véritables câbles pour donner passage aux quantités énormes d'électricité que les machines des stations centrales déversent dans le réseau des conducteurs.

Pour qu'un courant d'électricité ait la possibilité de se produire, il faut qu'il puisse parcourir un circuit fermé. Il faut donc un câble d'aller et un câble de retour à la machine.

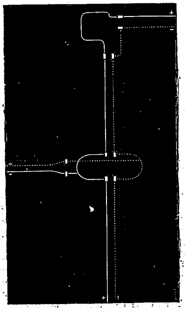

Fig. 6. — Figure théorique de la jonction de deux conduites principale et d'immeuble.

Les deux conducteurs sont empâtés dans une substance isolante contenue dans des tubes en fer. Ces tubes sont soudés à recouvrement et revêtus d'un ruban goudronné destiné à les préserver de l'oxydation.

On en fait de dix dimensions différentes.

Le plus gros a un diamètre extérieur de 8 centimètres. Nous sommes bien loin de ces énormes tuyaux de gaz de plus d'un mètre de diamètre pour lesquels il faut creuser de vastes tranchées et dont la pose est si coûteuse et incommode.

Quand on veut réunir deux tronçons de conduites principales, on se sert d'une paire d'arcades en cuivre dont les deux extrémités portent des ouvertures ayant la forme demi-cylindrique des conducteurs. On introduit les deux extrémités du fil d'aller dans les ouvertures d'une des arcades et on les serre au moyen d'une vis de pression. On joint de même les extrémités du fil de retour. La continuité du circuit se trouve alors établie.

L'embranchement d'une conduite d'immeuble sur la conduite principale est représentée fig. 6. Elle s'effectue à l'aide d'une boîte de jonction en fonte (fig. 7), placée en face de la maison à éclairer et sur le chemin même de la conduite principale.

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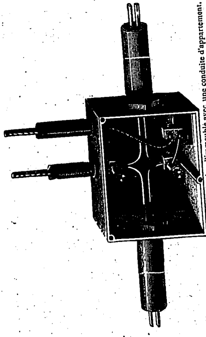

Fig. 7. — Boîte de jonction d'une canalisation d'immeuble avec une conduite d'appartement.

A l'intérieur, les conducteurs sont mis à nu et réunis deux à deux au moyen d'arcades comme celles que nous venons de décrire, mais munies en outre d'éperons auxquels viennent se rattacher les deux conducteurs de la conduite d'immeuble.

Pour greffer les conduites des différents appartements sur la conduite générale d'immeuble, on emploie des boîtes en fonte analogues à la précédente. Elles ne sont pas remplies de matière isolante, mais sont hermétiquement fermées et recouvertes d'un enduit isolant.

Elles sont en outre munies d'un coupe-circuit

Le coupe-circuit est un petit fil en plomb de grosseur convenable, dont le but est de rendre impossible toute cause d'incendie et de sauvegarder les lampes des accidents que pourrait occasionner un courant trop intense.

Supposons que pour une raison ou pour une autre il vienne à se produire un contact direct entre les fils d'aller et de retour. La plus grande partie du courant passera par là et les lampes s'éteindront, mais, de plus, la résistance opposée au courant étant bien plus faible qu'elle ne l'était quand il passait entièrement par les lampes, son intensité deviendra beaucoup plus forte et les conducteurs s'échaufferont.

Or, le point de fusion du plomb sera atteint longtemps avant que la température des fils de cuivre ne puisse présenter la moindre chance d'enflammer l'étoffe ou l'enduit isolant qui les recouvre. Dès qu'une portion quelconque du circuit commence à s'échauffer, les fils de plomb qui s'y trouvent fondent et arrêtent net le courant dans la partie menacée.

Il y a un coupe-circuit, nous l'avons dit, dans chaque boîte de jonction d'appartement, mais il y en a aussi à chaque ramification du courant, et pour chaque groupe de lampes. On voit quelles précautions méticuleuses Edison a prises pour écarter jusqu'à la possibilité la plus improbable de danger.

Quand un coupe-circuit a joué, un employé de la compagnie visite l'embranchement qui se trouve par là même isolé, répare le défaut du circuit et remet un fil en plomb. Ce fil se trouve disposé dans une sorte de bouchon en bois ou en plâtre muni d'un pas de vis. On le visse à la main dans une petite douille placée à l'endroit où a été ménagé le coupe-circuit. Le remplacement s'effectue donc de la manière la plus simple.

CHAPITRE IV

LA MACHINE

Principe de la machine. — Son rendement. Différentes espèces de machines.

On appelle champ magnétique tout espace dans lequel agissent des forces magnétiques; ainsi l'espace qui entoure un aimant est évidemment un champ magnétique.

Tout le monde sait que si dans le champ d'un aimant on introduit des objets en fer, ils seront attirés plus ou moins vivement selon que l'intensité du champ sera plus ou moins forte, ou, en d'autres termes, suivant que l'aimant sera plus ou moins puissant. Mais un champ magnétique donne encore lieu à d'autres phénomènes. Si on y promène tout ou partie d'un circuit conducteur, les différentes portions du circuit

ainsi mises en mouvement dans le champ tendront à faire naître dans le circuit tout entier des courants électriques qui seront d'autant plus intenses que la vitesse imprimée à la partie mobile du circuit sera plus grande et que l'intensité du champ sera plus forte.

Dans une machine électrique Edison, le champ est produit par un *électro-aimant* double (1).

Le circuit est formé de deux parties :

L'une, l'*armature*, mobile dans le champ magnétique, engendre le courant ; l'autre, fixe, est constituée par les lampes et les conducteurs. Une dérivation du circuit fixe passe dans les électro-aimants et en produit l'aimantation.

La partie mobile du circuit, qui est la *bobine* ou l'*armature* de la machine, se compose d'un fil de cuivre enroulé longitudinalement sur un cylindre de manière à le recouvrir sur toute sa surface. Les deux bouts libres du fil sont soudés ensemble, de telle sorte que toute la bobine forme un seul circuit fermé. Dans certaines machines Edison ce ne sont pas, à proprement

(1) Un électro-aimant est constitué par un ou plusieurs cylindres en fer autour desquels on enroule un tour de fil isolé. Quand on fait passer un courant à travers ce fil, le cylindre en fer s'aimante. Sa puissance magnétique est proportionnée à l'intensité du courant qui produit l'aimantation.

parler, des fils qui forment les génératrices du cylindre, mais des barres de cuivre isolées les unes des autres. Elles sont reliées entre elles par leurs extrémités au moyen de disques en cuivre de même diamètre que le cylindre et perpendiculaires à son axe. Les disques sont isolés les uns des autres. Chacun d'eux réunit les extrémités de deux génératrices, et les jonctions sont combinées de manière à ce que le tout constitue encore un circuit fermé.

On fait tourner l'armature autour de son axe entre les pôles de l'électro-aimant, parce que l'intensité du champ est la plus forte en cet endroit. Si toutefois la bobine se réduisait à ce que nous venons de dire il n'y aurait aucun courant. Cela tient au mode d'enroulement du fil. Il est tel que les courants élémentaires qui tendent à prendre naissance dans chacune des génératrices de l'armature sont deux à deux égaux et de sens opposé. Toutes les génératrices donnant lieu à des courants qui parcourent le circuit de l'armature dans un même sens se trouvent dans une même moitié de ce circuit. Il s'ensuit que la bobine se compose de deux moitiés tendant à être parcourues par deux courants égaux et de sens contraire. Il faut une disposition qui per-

mette à ces deux courants de se produire en les dirigeant dans le circuit extérieur.

A cet effet l'armature est munie d'un *commutateur*. Il se compose d'un cylindre beaucoup plus petit que le précédent, placé sur le même axe et dans son prolongement. On le voit (fig. 8) à l'extrémité opposée où se trouve la poulie. Les génératrices sont formées de barres de cuivre tout à fait isolées les unes des autres, mais reliées chacune à l'un des disques en cuivre de la bobine.

On place deux *balais* formant les extrémités du circuit extérieur, sur deux génératrices opposées du commutateur, alors les deux courants de la bobine qui étaient opposés l'un à l'autre s'élancent ensemble par le débouché commun dans les conducteurs en s'ajoutant, au lieu de se paralyser mutuellement.

Ce qui se passe ici est analogue à ce qui aurait lieu dans deux piles réunies par leurs pôles de même nom ; aucun courant ne se produirait ; mais qu'on vienne à relier par un fil de cuivre le fil qui joint les deux pôles positifs à celui qui joint les pôles négatifs, aussitôt le courant prendra naissance.

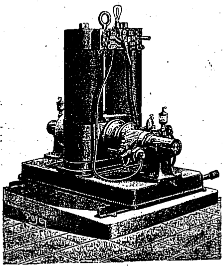

Fig. 8. — Dynamo de 120 lampes.

TYPES DES MACHINES EDISON

NOMBRE de lampes A qu'elle peut alimenter	FORCE en CHEVAUX	FORCE électromotrice en volts	INTENSITÉ en ampères	PRIX
25	$3\frac{1}{2}$	110	18	1,500
50	$6\frac{1}{2}$	110	38	2,800
100	$12\frac{1}{2}$	110	75	3,500
200	25	110	150	5,000
300	$37\frac{1}{2}$	110	225	7,000
500	$62\frac{1}{2}$	110	385	10,000
1,000	125		750	15,000

On peut toujours remplacer une lampe A par deux lampes B.

Il existe aussi un petit modèle pouvant alimenter 20 lampes de 6 bougies avec un cheval de force. Ce dynamo convient pour de petites installations privées. Son prix est de 400 francs.

TYPES DES LAMPES EDISON

DÉSIGNATION DES LAMPES		POUVOIR ÉCLAIRANT		NOMBRE DE VOLTS	INTENSITÉ EN AMPÈRES	RÉSISTANCE A CHAUD EN OHMS	NOMBRE DE LAMPES PAR CHEVAL	PRIX
TYPE	SÉRIE	CANDLES	CARCELS					
A	1	100	10.80	90 à 110	4.3	22	2	13f »
»	2	32	3.45	»	1.4	70	5.5	7.50
»	3	16	1.72	»	0.75	135	8	6. »
»	4	10	1.08	»	0.55	170	13.5	6. »
B	1	16	1.72	45 à 55	1.50	42	11	6. »
»	2	8	0.86	»	0.75	69	16	6. »
X	1	6	0.645	28 à 32	1. »	»	25	5. »
»	2	4	0.43	12 à 18	1.4	»	30	5. »

RÉGULATEUR

Le régulateur se compose d'une boîte carrée (fig. 9) surmontée d'un manipulateur tout semblable à celui du télégraphe à cadran de Bréguet et munie de deux bornes.

L'une d'elles est reliée à l'axe de la manette, l'autre à l'extrémité d'un fil en maillechort placé à l'intérieur de la boîte et enroulé sur une carcasse en bois, de manière que les différentes spires soient isolées les unes des autres.

Des secteurs isolés du cadran partent des fils de cuivre allant se rattacher successivement au fil de maillechort en des points de plus en plus éloignés de son extrémité.

Le courant arrivant par l'une des bornes à la manette, passe dans le fil en maillechort à travers le secteur qui est en contact avec elle et ressort par l'autre borne.

En déplaçant la manette on augmente ou on diminue à volonté la quantité de fil interposée et on modifie par suite la résistance du circuit; on peut ainsi faire passer les lampes par toutes les intensités, depuis le rouge le plus sombre jusqu'au blanc éclatant.

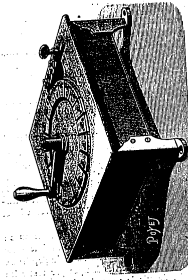

Fig. 9. — Régulateur ordinaire.

DYNAMO DE 25 LAMPES A

13 LAMPES A ET 24 LAMPES B OU 50 LAMPES B

Force effective absorbée : 3 1/2 chevaux-vapeur.
Prix : **1,500** francs.
Dimensions de la base : 0m,718 × 0m,516. — Hauteur : 0m,780. — Poids : 350 kil.
Poulie : diamètre, 0m,180 ; largeur, 0m,090. — Nombre de tours ; 1,500.

PRIX MOYEN DU MATÉRIEL ÉLECTRIQUE *Machine, Régulateur, Commutateurs, Douilles, Lampes, Fils, etc.* INSTALLATION					
INDUSTRIELLE			PARTICULIÈRE		
25 *A*	13 *A* et 24 *B*	50 *B*	25 *A*	13 *A* et 24 *B*	50 *B*
2.300 fr.	2.420 fr.	2.550 fr.	2.630 fr.	2.775 fr.	2.930 fr.

DYNAMO DE 50 LAMPES A

25 LAMPES A ET 50 LAMPES B OU 100 LAMPES B

Force effective absorbée : 6 1/2 chevaux-vapeur.
Prix : **2,800** francs.
Dimensions de la base : 0m,920 × 0m,590. — Hauteur : 0m880. — Poids : 485 kil.
Poulie : diamètre, 220 ; largeur 110. — Nombre de tours : 1,400.

PRIX MOYEN DU MATÉRIEL ÉLECTRIQUE *Machine, Régulateur, Commutateurs, Douilles, Lampes, Fils, etc.* INSTALLATION					
INDUSTRIELLE			PARTICULIÈRE		
50 *A*	25 *A* et 50 *B*	100 *B*	50 *A*	25 *A* et 50 *B*	100 *B*
4.120 fr.	4.370 fr.	4.620 fr.	4.815 fr.	5.115 fr.	5.415 fr.

DYNAMO DE 100 LAMPES A

50 LAMPES A ET 100 LAMPES B OU 200 LAMPES B

Force effective absorbée : 12 1/2 chevaux-vapeur.

Prix : **3,500** francs.

Dimensions de la base : $0^m,980 \times 0^m,590$. — Hauteur : 0^m795. — Poids : 550 kil.

Poulie : diamètre, 300 ; largeur, 200. — Nombre de tours : 1,200.

PRIX MOYEN DU MATÉRIEL ÉLECTRIQUE

Machine, Régulateur, Commutateurs, Douilles, Lampes, Fils, etc.

INSTALLATION

INDUSTRIELLE			PARTICULIÈRE		
100 *A*	50 *A* et 100 *B*	200 *B*	100 *A*	50 *A* et 100 *B*	200 *B*
3.950 fr.	6.450 fr.	6.950 fr.	6.550 fr.	7.150 fr.	7.750 fr.

DYNAMO DE 200 LAMPES A

100 LAMPES A ET 200 LAMPES B OU 400 LAMPES B

Force effective absorbée : 25 chevaux-vapeur.

Prix : **5,000** francs.

Dimensions de la base : $1^m,315 \times 0^m,765$. — Hauteur : $1^m,330$. — Poids : 1,400 k.

Poulie : diamètre, 360 ; largeur, 260. — Nombre de tours : 1,200.

PRIX MOYEN DU MATÉRIEL ÉLECTRIQUE

Machine, Régulateur, Commutateurs, Douilles, Lampes, Fils, etc.

INSTALLATION

INDUSTRIELLE			PARTICULIÈRE		
200 *A*	100 *A* et 200 *B*	400 *B*	200 *A*	100 *A* et 200 *B*	400 *B*
9.500 fr.	10.500 fr.	11.500 fr.	12.300 fr.	13.500 fr.	14.700 fr.

DYNAMO DE 300 LAMPES A

150 LAMPES A ET 300 LAMPES B OU 600 LAMPES B

Force effective absorbée : 37 1/2 chevaux-vapeur.

Prix : **7,000** francs.

Dimensions de la base : $1^m,600 \times 0^m,740$. — Hauteur : $1^m,460$. — Poids : 2,610 k.

Poulie : diamètre, 400 ; largeur, 300. — Nombre de tours : 950.

PRIX MOYEN DU MATÉRIEL ÉLECTRIQUE

Machine, Régulateur, Commutateurs, Douilles, Lampes, Fils, etc.

INSTALLATION

INDUSTRIELLE			PARTICULIÈRE		
300 *A*	150 *A* et 300 *B*	400 *B*	300 *A*	150 *A* et 300 *B*	600 *B*
13.560 fr.	15.060 fr.	16.560 fr.	17.700 fr.	19.500 fr.	21.300 fr.

DYNAMO DE 500 LAMPES A

250 LAMPES A ET 500 LAMPES B OU 1,000 LAMPES B

Force effective absorbée : 62 1/2 chevaux-vapeur.

Prix : **10,000** francs.

Dimensions de la base : $2^m,515 \times 0^m,840$. — Hauteur : $1^m,400$. — Poids : 3,000 k.

Poulie : diamètre, 450 ; largeur, 350. — Nombre de tours : 750.

PRIX MOYEN DU MATÉRIEL ÉLECTRIQUE

Machine, Régulateur, Commutateurs, Douilles, Lampes, Fils, etc.

INSTALLATION

INDUSTRIELLE			PARTICULIÈRE		
500 *A*	250 *A* et 500 *B*	1,000 *B*	500 *A*	250 *A* et 500 *B*	1,000 *B*
20.350 fr.	22.850 fr.	25.350 fr.	27.500 fr.	30.500 fr.	33.500 fr.

INSTALLATIONS

INSTALLATIONS D'ÉCLAIRAGE EDISON

FRANCE

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Hôtel de Ville.........	Paris	Salles et bureaux		500
Banque de France.......	—	Impr. et bureaux		150
Galeries G. Petit........	—	Expos. de tableaux		200
M. Ch. Porgès....... ..	—	Appartements		120
Hôtel Continental.......	—	Restaurant		60
Gr. Magasins du Louvre.	—	Bureaux		60
Maison Boissier.........	—	Magasins		110
M. A. Lahure.	—	Imprimerie		80
Maison Hachette........	—	Ateliers de reliure		80
MM. Heberlé et Loddé..	—	Fabr. de plumes		60
Pochet................	—	Verrerie		17
Lecouteux et Garnier....	—	Bur. et sall. de dess.		34
Veuve F. Potin.........	—	Chocolat., caves		90
Poiret frères et neveux..	—	Laines et cotons		90
Bouvalst.	Abbeville	Brasserie		17
David et Huot..........	Amiens	Filat. de cachemire		60
A. Laprerie, Laroche-Joubert et Cie...........	Angoulême	Const. de machines		120
Jomaron.	Annonay	Mégisserie		60
G. Dantier.............	Argenteuil	Cartonnerie		17
Parfait Dubois..........	Avesnes (N.)	Filature de laines		60
R. Lœffel et Cie........	Blainville	Filature de coton		150
Exposition.	Bordeaux	Galeries		120
MM. Maurel et Prom et Maurel frères........	—	Huilerie		150
P. Dandicolle fils, Gaudin aîné................	—	Fab. de conserves		80
Mossant frères..........	Bs de Péage	Fab. de chapeaux		17

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Th. Diederichs.	Bourgoin	Tissage de soie		120
Exposition..............	Caen	Galeries		250
MM. Ch. Colliard.	Cateau	Tiss. de laines		150
P. Fourré.	Cognac	Vins et alcools		77
Ph. Bazin.	Condé-s-Noir.	Filature		73
Boissaux.	Conflandey	Papeterie		120
Nectoux.	Dijon	Confiserie		17
Casino................	Eaux-Bonnes	Casino et jardin		34
MM. Darblay et Béranger.	Essonnes	Papeterie		180
Courtin.	Gournay	Scierie		17
Lemoine.	Ivry-sur-Seine	Forges		17
Société industrielle et commerciale Edison.......	—	Ateliers		250
MM. Febvrel frères.. . .	Jarménil	Filature		120
Delattre père et fils	Lille	—		120
Lambert-Caillemer.......	Lisieux	—		120
Marius Chevallard.......	Lyon	Apprêts et moires		20
Ch. Sabatié et C^a^.......	Mazamet	Laines et peaux		128
Barthas et Bonhomme ...	—	Filature de laines		17
A. Bru et C^ie^.	—	Laines et peaux		17
David Molinier..........	—	Apprêts d'étoffes		25
Alba La Source.........	—	Fabrique de draps		60
A. Brasme et C^ie^.	Mazingarbe	Brasseries		17
A. Walcker.............	Méry-sur-Oise	Art. de voyages		120
Chagot et C^ie^.....	Monceau-l.-M.	Mines de Blanzy.		17
G. Gerbaud.	Narbonne	Vins		17
M^me^ Veuve Raynaud et C^ie^	—	Fab. de carrelages		27
M. Marnier-Lapostolle. ..	Neauphle-le-Château	Distillerie		17
Exposition.........	Nice	Galeries		1500
MM. Menier.	Noisiel	Chocolaterie		17
Victor Peters.	Nomexy	Filature		60
Chevallier frères.	Orléans	Fab. de couvert^res^		17

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Dessaux fils.	Orléans	Vinaigre		17
Saintoin frères.........	—	Confiserie		17
M^me^ Veuve Heid et fils .	Pau	Const. de machines		17
MM. Agache fils.	Pérenchies	Tissage		17
J. Bardou et fils.	Perpignan	Papier à cigarettes		60
Fenal frères.	Pexonne	Faïencerie		60
Édouard Lefebvre.	Pont-Authou	Filature		150
Anthoni Moebs et C^ie^. .	Remiremont	—		120
Blanchet et Kléber.	Rives	Papeterie		80
Motte et Meillassoux.....	Roubaix	Teinturerie		400
Louis Lefebvre....... .	—	Filature		300
Auguste Lepoutre.......	—	Filature et tissage		300
Ternynck frères.........	—	—		17
Dillies frères..........	—	—		60
Amédée Prouvost et C^ie^..	—	Peignage et filat.		150
Motte-Bossut fils........	—	Filature de laine		120
Wibaux-Florin.	—	—		60
Fonderie de l'État.......	Ruelle	Fonder. de canons		240
MM. Charaire et fils.....	Sceaux	Imprimerie		44
Compagnie Française du Celluloïd.	Stains	Ateliers		60
Poudrerie de l'État......	Saint-Chamas	Poudrerie		60
Société des tresses et lacets.	St-Chamond	Passementerie		120
MM. Th. Véron.........	St-Didier-la-S	Papeterie		60
P. Schmidt fils.	Saint-Dié	Filature		137
C. Eugène.	Saint-Maur	Fab. de couvert^res^		17
F. Odiaux.	Saint-Quentin	Miroiterie		17
Trocmé.	—	Tissus de coton		60
David Trouillier et Adhémar.	—	—		60
Les fils de Guillaumet...	Suresnes	Teinturerie		150
Zuber, Rieder et C^ie^. ...	Torpes	Papeterie		17
Sirven et C^ie^.	Toulouse	Papeterie		17

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Pollet-Caulliez et fils	Tourcoing	Peignage		300
F. Mazurel et fils	—	Peignage et filature		17
Caulliez père et fils et Delaoutre	—	—		60
A. Clerget et Cie	Vesoul	Fab. de pâtes alim.		60
Berthelot	Vif (Isère)	Fab. de ciment		25
Mulsant père et fils	Villefranche (Rhône)	Filature de coton		120
Étienne Seigle	—	Minoterie		240
Guérimand et Cie	Voiron	Papeterie		34
Jaubert-Audras et Cie	—	Fabrique de soie		120
Dewulf Cailleret et fils	Dunkerque	Élévateur		17
Guillermin et Blancy	Saint-Vallier	Filature de soie		25
Deneux frères	Cagny	Usine		25
Bailly fils	Reims	—		25
Huret et Lagache	Pt-de-Briques	—		25
Evrard et Cie	Rue	—		25

ANGLETERRE

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Holborn viaduct	Londres	Usine centrale		950
Consolidated telephone Ce	—	Téléphones		120
Phillips Bros	Hackney wick	Fils de cuivre		130
Robey et Ce	Lincoln	Constructeurs		120
Archibald Coats, esq	Paisley	—		150
T. Tayler Smith, esq.	Enfield	—		65
B. Verity et Sons	Londres	Appareilleurs		60
Station de Waterloo	—	Gare		160
Collège de Londres	—	Collège		160
Tarawera union steamship Ce limited	Nlle-Zélande			150

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Waihora union steamship Ce limited	Nlle-Zélande			150
Building at Glascow for the Tasmania steam navigation Ce	Glascow	Administration		150
Building at Greenock for the Brazilian steamship Ce	Greenock	Administration		130
Building by William Denny et Bross	Dumbarton	Administration		360
Her Majesty's Troopship " Malabar "		Vaisseau de guerre		373
Holborn restaurant	Londres	Restaurant		1000
Dining rooms and library of the House of Commons	Westminster	Parlement		150
Trafalgar Colliery	Cinderford	Houillère		60
Society of Arts	Londres	Association		50
London Brighton and South Coast railway company	—	Éclairage de trains express		
Colonel Gouraud	—			30
Show Rooms and Offices of the Manchester and district Edison electric light Ce limited	Manchester	Salons et bureaux		90
Messrs Mather et Platt, Salford Iron Works	—	Forges		1000
Messrs D. Moseley et Sons	—	—		1000
Mrs Wright Turner et Sons	Salford	—		900
Mr George Hopwood	Near Bury	—		120
Messrs R. R. Jackson et Ce	Blackburn	—		120
Messrs Gottschalk	Manchester	—		100
The " Harrison " patent steam steering Ce	Salford	—		70

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Théâtre royal........ ..	Manchester.	Théâtre		50
Manchester " Guardian ".	—			120
Manchester " royal institution.".	—	Galerie de peinture		80

ALLEMAGNE

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Gazette de Cologne.	Cologne	Gazette		181
Röschke et Buschkiel....	Zittau	Électriciens		17
V. Vogel...............	Munich	Brasserie		60
Gare centrale.........	Strasbourg	Gare		2000
Van der Heydt.	Elberfeld	Particulier		120
Chantier de la marine impériale.	Dantzig	Chantier		120
Gouvy frères et Cie.	Hombourg ht	Filature		80
S. Lindauer et Cie......	Cannstadt	Fab. de corsets		130
Ungerer et Schulze.....	Strasbourg	Électriciens		17
Émile Ascherberg.	Dresde	Fab. de pianos		250
G. Schaeffer.	Gœppingen	Électricien		17
Gebr. Lœvy.	Passau	Magasin		17
Geo. Andres............	Creuznach	Fabrique de cuirs		17
W. Hepner.............	Gœrlitz	Négociant		17
John Pet. Schneider.	Neuwied	Filature		28
C. Durkopp.	Billefeld	Fab. de machines à coudre		34
Fabrique de sucre.......	Rositz	Sucrerie		250
Brasserie Bohémienne....	Berlin	Brasserie		60
Fisher et Seige.	Pœsneck	Tissage		128
Residenz Theatre.......	Munich	Théâtre		750
Schaeffer et Hauschner...	Berlin	Fab. de lustres		17
Jurss et Crotognio.	Rostock	Chantier		23
Berghausen et Ce.......	Cologne	Société électrique		214

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Norddeutsche Affinerie...	Hambourg	Affinerie		17
Spiecker et Cie.........	Cologne	Électriciens		17
Rosenfeld et Ce.	Berlin	Fab. de linoléum		78
Daunenbaum frères......	Warrenton	Fab. de sucre		60
Fabrique de papier.	Coswig	Papeterie		76
Usine à gaz.	Berlin	Gaz		60
W. Reisser............	Stuttgart	Théâtre		1000
Sucrerie...............	Ahrensbeck	Sucrerie		150
Siechen.	Berlin	Restaurant		60
A. Hoffmann.	Neugersdorf	Filature		17
J. M. Woith............	Heidenheim	Const. de machines		60
Sucrerie.	Neustadt	Sucrerie		150
Sucrerie........... ...	Güstrow	—		120
Union club............	Berlin	Club ...		120
Ressource.	—	—		120
Goerne et Cie.	Ahlen	Mines strontianite		60
J. Neuhaus Nachforger...	Crefeld	Teinturerie		47
Fr. Busch..	Werden	Usine		17
Pfankuch et Reinhardt...	Cologne	Électriciens		32
Aders...........	Magdebourg	Fab. de cuivre		60

AUTRICHE

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Théâtre communal.	Brünn	Théâtre		1000
Société de Fives-Lille....	Neusatz	Usine		15
Schoeller et Ce.	Czakowitz	Sucrerie		17
J. Huckels Sœhne.......	Neutitschein	Usine		80
Sucrerie................	Czelechowitz	Sucrerie		120
Moses Loew Beer.......	Brünn	Filature de laine		220
Café Union......	Vienne	Café		320
S. Schwarz............	Brimu	Filature de laine		230
S. Auspitzer......	Rohatetz	Sucrerie		220

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Baron Steinbövel........	Chutovak	Fab. de liqueurs		60
Neues Wiener Tagblatt..	Vienne	Journal		260
Théâtre national........	Prague	Théâtre		1600
Union Mühle....	Budapest	Moulin à vapeur		250
BELGIQUE				
Station centrale....	Bruxelles	Station centrale		250
Desmet et Dhanis.......	Gand	Filature		60
E. L. Godin et fils......	Huy	Fab. de papier		60
N. Porta et Cie.........	Huy	Fonderie		60
Rey aîné.......	Gand	Filature		60
Bêllard et Best..........	Anvers	Const. de machines		17
Ancion Wauthier et Cie..	Gingelom	Sucrerie		60
Brou................	Monceau	Haut fourneau		80
Laman...........	Limal	Papeterie		80
Musée du Nord.........	Bruxelles	Théâtre		60
Charbonnages du Boubier.	Chatelet	Charbonnage		60
Charbonnages de Bascoup.	Pr. Marlemon:	Charbonnage		80
ESPAGNE				
Gouvernement.........	La Carraca	Arsenal		500
Gouvernement...	Carthagena	—		150
Labrador.......	Madrid	Usine		44
Gosalvez é Hijos.... ...	Villalgordo	—		70
Café du Levante..	Madrid	Café		25

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
HOLLANDE				
Krasnopolski...........	Amsterdam	Café		68
J. Reynvaan (de Weischsel)................	—	Minoterie		78
Wester Suckerraffinadery.	—	Sucrerie		378
Spakler et Tetterode.....	—	—		145
Nygh et Zoon..........	Rotterdam	Imprimerie		84
De Pesters Kooy et Cie..	Amsterdam	Brasserie		16
Leesmuseum...........	—	Salle de lecture		60
Wester Suckerraffinadery.	—	Sucrerie		17
C. A. Spin et Zoon.....	—	Imprimerie		24
C. W. Schonebaum.	Groningen	Tissage		60
Station centrale........	Amsterdam	Station centrale		1000
Station centrale..	Rotterdam	—		1000
ITALIE				
Station centrale...	Milan	Station centrale		6000
Benigno Crespi.......	Vaprio	Filature de coton		55
Benigno Crespi........	—	—		180
Giuseppe Crespi et Cie..	Vigevano	—		120
Cavalieri et Franco.....	Bologne	Moulin à vapeur		60
Giacomo Missim..	Pise	Fabrique de tissus		60
A. A. Ponti...........	Solbiate	—		120
A. M. Crossy.	Nebbinuo	Filature de tissus		30
Illi Cassanello fu Pietro..	Gênes	Moulin à vapeur		60
Amman et Wepfer.. ...	Pordenone	Filature de coton		54
Bodmer et Cie..... ...	Naples	Moulin à vapeur		30
Crespi et Cie...........	Nembro	Filature de coton		120
Auguste Traxler........	Livourne	Villa		30
" Sirio " Société Raggio.	Gênes	Vapeur		200

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Giuseppe Crespi et Cie...	Cassolo	Filature de coton		60
Scerno Gismondi et Cie..	Gênes	Huilerie		30
Giovanni Monti.........	Teuzanico	Filature de soie		16
Canapificio Veneto......	Trévise	Filature de chanvre		140
Antonio Oltolina.... ..	Asbo	Filature de laine		60
Cotonificio Veneziano,...	Venise	Filature de coton		370
Giacomo Nissim.........	Pise	Fabrique de tissus		250
Fornaci alle Sieci.......	Sieci	Four à briques		60

RUSSIE

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Caucas et Mercur........	S. Volga	Steamer		80
Alferaki................	Taganrog	Moulin		80
Hutcheson et Cie...	Moscou	Filature		310
Chemin de fer........ .	Konotop	Gare		120
Dembitzky.............	Okoulowka	Fabrique de sacs		60
Melzer.....	Cronstadt	Fab. de meubles		62
Kœnig......	St-Pétersbrg	Raffinerie		17
Goujon.......	Moscou	Filature		60
Cie Ingerois......... .	Ingerois	Papeterie		60
Ricks.................	Helsingfors	—		60
Johnson............. ..	Yveskylä	Scierie		17
Finlayson et Cie........	Tammerfors	Filature		800
Arppés................	Wörtzilä	Moulin		17
Cie Josefow............	Josefow	Sucrerie		299
Bormann et Cie...... ...	Varsovie	—		17
Schmidt...............	Riga	Fabrique de ciment		20
Caucas et Mercur...... .	Astrachan	Atelier		60
L. Knopp.......... .	Moscou	Filature		250
A. Bede.........	—	Usine		34
G. Liszt.......	—	—		200
Efremoff.....	St-Pétersbrg	Moulin		34

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
R. Farkac et Cie.... ...	Dombrowa	Usine à machines		34
Lilpop Rau et Löwenstein.......	Varsovie	Usine		40
K. Brühl..............	—	—		260

ÉTATS-UNIS D'AMÉRIQUE

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Whitney Paper Co......	Holyoke, Mas.	Fab. de papiers		120
Sayles et Washburn....	Mechanissville, Ct.	Filature		132
Boston Rubber Shoe Co..	Boston, Mass	Caoutchouc		60
Hinds, Ketcham et Co...	N. Y. City	Imprimeur		240
N. Y. et Norwich Line..	City of Worcester	Bateaux vapeur		325
McKee et Fuller.......	Catasauqua, Pa.	Fab. de wagons		120
Seymour, Sabin et Co ..	Stillwater, Minn.	Machines agricoles		250
Pemberton Co..........	Lawrence, Mass.	Laines		125
Aitken, Sen et Co......	18th street and Broadway	Art. de fantaisie		120
Borden Block..........	Fall River, Mass.	Magas., bureaux		137
Brooklyn Sugar Refinery.	Brooklyn	Raffin. de sucre		80
Pottstown Iron et Co.. .	Pottstown, Pa.	Fonderie		60
J. P. Squire...	East-Cambridge, Mass.	Conserves		130
Clark, Thread Co.......	Newark N. J.	Fabrique de fil		125
Calumet Club..........	Chicago	Club		65
N. K. Fairbanks.......	—	Hôtel privé		65

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Gazette Publishing C° ...	Davenport, Ia.	Journal		120
Fall River Bleachery.....	Fall River, Mass.	Blanchisserie		85
Merrimac Mfg C°.	Lowel, Mass.	Imprimerie		250
Ladd et Logan..........	San Francisco	Agence		60
Matthiessen et Weichers.	Jersey City, N. J.	Raffinerie		300
Boston Sugar Refinery...	East Boston, Mass.	—		125
Rittenhouse Mfg C°.	Passaic	Soierie		65
Arlington Mills..........	Lawrence, Mass.	Filature		130
Trenton Iron C°........	Trenton, N. J.	Tréfilerie		75
John V. Farwel.........	Chicago	Draperie		130
McCormick Harvesting Neach C°...........	—	Machines agricoles		60
Carr et Hob[illegible]...	Bergen Point	—		120
William Strange.	Peterson, N. J.	Soieries		60
Cooke Locomotive et Machine Works.........	—	Locomotives		60
Sperry et Barnes.	New Britain, Ct.	Conserves		240
E. S. Jaffray et C°......	Broadway and Leonard street N. Y.	Draperie		80
D. F. Beatty.	Washington, N. Y.	Orgues, pianos		250
American Banknote C°...	Liberty street and Broadway N. Y.	Impression de billets de banque		125
Oregon Railway and Navigation...............	Portland Docks	Docks		480

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Manhattan Railway C°...	98th str. and 3rd avenue, V. Y.	Ateliers de chemin de fer		125
Oregon Railway and Navigation C°...........	Queen of Pacific	Vapeur		250
Merrick Thread C°.....	Holyoke, Mas.	Fabrique de fil		98
Max Ams.	372, Greenwich street, N. Y.	Conserves		65
Hôtel Vendôme.	Boston, Mass.	Hôtel		63
Worumbo Mfg C°.....	Lisbon Falls, M. E.	Filature		480
Nathan et Dreyfus.	106th str. and East River	Graiss. et inject.		125
Alfred Dolge.	Little Falls	Tables d'harmonie pour pianos		126
Tingne, House et C°. ..	Glenville, Conn.	Draperie		130
Palmer House.	Chicago	Hôtel		60
R. H. Coleman.	Cornwall, Pa.	Fonderie		60
James Harrison....... ..	Newburg, N. Y.	Filature		126
James Taylor.	Newburg, N. Y.	—		125
Record Room...... ...	Washington, D. C.	Impr. de l'État		12
Rand, McNally et C°....	Chicago	—		12
Baldwin Locom. Works..	Philadelphia, P. A.	Locomotives		75
F. C. Durant....	Blue Mountain Lake	Hôtel		125
J. B. Stetson et C°	Fourt and Montgomery str., Phil.	Chapellerie		120

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Marshall Field et Cᵒ. ..	Chicago	Draperie		60
J. Pierpont Morgan......	36 th. street and Madison avenue, N. Y.	Hôtel particulier		300
Pemberton Mill Cᵒ.... .	Lawrence, Mass.	Filature		250
Worumbo Mfg Cᵒ.. ..	Lisbon Falls, M. E.	—		150
W. M. Singerly..... ..	Phila Record	Journal		225
Harder Knitting Cᵒ... ..	Hudson, N.Y.	Tricoterie		160
A. E. Martin.........	Anamosa, Iowa	Pénitencier		250
S. H. Everett...........	98 Barclay 4 N. Y.	Hôtel		250
Academy of Music.......	Chicago	Théâtre		150
Lorraine Woolen Mill...	Pawtucket	Filature		150
Laurel Lake Mill........	Fall River, Mass.	—		150
Slater Cotton Cᵒ.......	Pawtucket, R. I.	—		300
J. Hood Wright.	Fort Washington, N. Y.	Filature		240
National tube Works ...	McKee, sport Pa.	Tuyauterie		65
Winona Mill Cᵒ.	Winona, Minn.	Minoterie		70
James Gordon Bennett...	Yacht Namouna	Yacht		120
S. H. Everett......... .	84 Chatham street, N. Y.	Hôtel		130
U. S. Rolling Stock Cᵒ..	Urbana Ohio	Fab. de wagons		128
Oregon Railway and Navigation Cᵒ....... . .	S.S. Columbia	Vapeur		120

NOMS	VILLES	NATURE DES LOCAUX	TYPE DE DYNAMO	NOMBRE DE LAMPES
Fairbanks et Cᵒ...	St-Johnsbury, V. T.	Fab. de balances		60
Weed, Parsons and Cᵒ ..	Albany, N. Y.	Imprimerie		150
Germania Mills.........	Holyoke, Mass.	Filature		70
Steamer Carolina.......	Bay-Line	Steamer		126
University State of Missoury........... . ..	Columbia, Mo	Université		60
Boston Herald.	Boston, Mass	Journal		150
Mill Creek Distilling Cᵒ..	Cincinatti, Ohio	Distillerie		60
Willimantic Linen Cᵒ....	Willimantic, Ct.	Fabrique de fil		60

NAVIRES ÉCLAIRÉS PAR LA LUMIÈRE ÉLECTRIQUE EDISON

NOMS	CLASSE	PROPRIÉTAIRES	TYPE DE DYNAMO	NOMBRE DE LAMPES
Trenton........	Cuirassé	Marine des États-Unis		150
Albatros.. ...	Garde-pêche	— —		150
Malabar........	Transport	Marine royale anglaise		400
Serapis.........	—	— —		400
Crocodile......	—	— —		400
Jumna.........	—	— —		400
Euphrates	—	— —		400
Dandolo.......	Cuirassé	Marine royale italienne		400
Chen Yuen.....	—	Marine chinoise		60
Fanwood......	Paquebot	Cie Centrale du New-Jersey		60
Namouna.......	Yacht	M. James G. Bennett		120
Atalanta........	—	M. Jay Gould		120
Kate Adams....	—	M. John D. Adams		120
Alaska........	Paquebot	Oregon Railway Nav. Ce		300
Columbia.......	—	— —		120
Queen of Pacific.	—	— —		250
Olympia........	—	— —		300
Kalama........	—	Northern Pacific R. R. Ce		60
Kinan..........	—	Oceanic Steamship Ce		100
Alameda........	—	— —		210
Mariposa.......	—	— —		150
City of Worcester	—	N. Y. et Norwich Line		325
Pilgrim.........	—	Fall River Line		910
Carolina........	—	Baltimore Steam Packet Ce		126
Virginia........	—	— —		126
Oregon.... ...	—	Williams et Guion Line		500
Tarawera.......	—	Union S. S. Ce of New-Zeal.		150
Waihora......	—	— —		150
Takapuna.......	—	— —		150
Clan Mac-Arthur.	—	Clan Line		150

NOMS	CLASSE	PROPRIÉTAIRES	TYPE DE DYNAMO	NOMBRE DE LAMPES
Clan Mac-Sntosh.	Paquebot	Clan Line		150
Minerva........	—	Compagnie la Platense		180
Apolo..........	—	— —		180
Adelaïde......	—	Adelaïde S. S. Ce		150
Valetta........	—	Peninsular et Oriental Ce		250
Sirio...........	—	Compagnie Reggio		150
Pateena........	—	Tasmanian Steam Nav. Ce		150
Rio Pardo.. ...	—	National Brazilian S. S. Ce		100
Rio Parana... ..	—	— —		100
Tongariro......	—	New-Zealand Shipping Ce		250
» »	—	— —		250
» »	—	— —		250
Alexandre II. ..	Vap. de riv.	Cie Caukase et Mercure		80
Maréchal Souvaroff..........	—	—		80

IMPRIMERIE CHAIX, 20, RUE BERGÈRE, PARIS. — 8883-4.

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SOCIÉTÉ ÉLECTRIQUE EDISON

Société anonyme au capital de Un Million de francs

PARIS. — 8, rue Caumartin. — PARIS

ÉCLAIRAGE

DE

VILLES, RUES, ÉDIFICES PUBLICS & PARTICULIERS

Châteaux, Magasins

THÉATRES, USINES, MUSÉES, HOPITAUX, CAFÉS, ETC.

LISTE

DES ÉTABLISSEMENTS ÉCLAIRÉS

PAR LES

Lampes EDISON

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
		FRANCE	
Hôtel de Ville..........	Paris.........	Salles et bureaux...	600
Banque de France......	—	Impr. et bureaux...	1200
Galeries G. Petit.......	—	Expost. de tableaux.	200
M. Ch. Porgès.........	—	Appartements......	120
Hôtel Continental.......	—	Restaurant.........	60
G^ds Magasins du Louvre.	—	Bureaux..........	60
Maison Boissier........	—	Magasins..........	110
A. Lahure.............	—	Imprimerie........	80
Maison Hachette........	—	Ateliers de reliure..	400
Héberlé et Loddé.......	—	Fabr. de plumes...	60
H. Pochet.............	—	Verrerie..........	17
H. Lecouteux et Garnier.	—	Bur. et sall. de dess.	34
Veuve F. Potin.........	—	Chocolat. Caves.....	90
Poiret frères et neveux.	—	Laines et cotons....	120
Patay..........	—	Fabr. de fleurs.....	25
H. Menier.............	—	Yacht.............	50
Crédit Foncier..........	—	Banque............	100
Diorama..............	—	Diorama...........	200
Gagne-Petit............	—	Magasins..........	500
Société Saint-Réquier...	—	Minoterie..........	50
Café de la Paix.........	—	Café..............	110
Opéra.................	—	Théâtre............	350

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
École Centrale	Paris	École	200
Joanne	—	Distillerie	50
Musée Grévin	—	Musée	300
A. Bouvaist	Abbeville	Brasserie	17
Dorel	Albertville	Vermicellerie	20^{c}
Duclaux	Allex	Ateliers	25
Poiret frères et neveux	Amiens	Laines et cotons	200
David et Huot	—	Fil. de cachemire	200
Hippolyte Grognet	—	Filature	200
Lecomte Lequenne	—	Filature	120
Cointreau fils	Angers	Distillerie	25
A. Laprérie, Laroche-Joubert et C^{ie}	Angoulême	Constr. de machines	120
A. Jomaron aîné	Annonay	Mégisserie	60
G. Dantier	Argenteuil	Cartonnerie	17
Buisset fils	Auxonne	Constructeur	25
Parfait Dubois	Avesnes (Nord)	Filature de laines	200
R. Loeffel et C^{ie}	Blainville	Filature de cotons	400
Maurel Prom et Maurel frères	Bordeaux	Huilerie	150
P. Dandicolle fils et Gaudin aîné	—	Fab. de conserves	120
M. Bussy	—	Usine	20^{c}
Poizat et Coquard	Bourg-de-Thizy	Tissage	200
Th. Diederichs	Bourgoin	Tissage de velours	120
Baudin père fils	Brou	Tannerie	25
Mossant frères	B^{r} de Péage	Fab. de chapeaux	17
Deneux frères	Cagny	Usine	25
J. Roger	Carcassonne	Fab. de machines	20
Ch. Colliard	Cateau	Tiss. de laines	150
Toffin et C^{ie}	Caudry	Filature	25
Raguet et C^{ie}	Chauny	Filature	17
P. Fourré	Cognac	Vins et alcools	77
Ph. Bazin	Condé-s/N	Filature	73
Léon Bazin	—	Filature	25
Ch. Boisseaux	Conflandey	Papeterie	120
Vve J.-M. Aussedat et C^{ie}	Cran	Filature	120
Aubin	Darnetal	Tissage	150
Cl. Nectoux	Dijon	Confiserie	17

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Dewulf, Cailleret et fils	Dunkerque	Élévateur	17
Casino	Eaux-Bonnes	Casino et jardin	34
Usine Élévatrice	Emmerin	Élévateur	25
Darblay et Béranger	Essonnes	Papeterie	180
M. de Rothschild	Ferrières	Château	120
L. Sauvage	Fives-Lille	Filature	200
Halbout et C^{ie}	Flers	—	300
Ch. Belin	Fourmies	—	200
Grande Chartreuse	Fourvoirie	Distillerie	35
Saint frères	Gamaches	Filature	300
Outhenin-Chalandre	Geneuille	Papeterie	200
Courtin	Gournay	Soierie	17
Chignier frères et C^{ie}	Grandris	Tissage	40^{c}
J. Badier et Paulin	Grenoble	Usine	20^{c}
Fritz Koechlin et C^{ie}	Héricourt	Tissage	104
Perrin, Panhard et C^{ie}	Ivry	Usine	20^{c}
Lemoine	Ivry-s/Seine	Forges	17
Société Industrielle et Commerciale Edison	—	Ateliers	250
Febvrel frères	Jarménil	Filature	200
Ch. de Montgolfier et C^{ie}	La Haye Desc.	Papeterie	100
André neveu	La Tour-du-Pin	Passementerie	40
A. Chappée	Le Mans	—	50
P. Ligneul fils	—	Minoterie	40
Mines de	Lens	Mines	25
L. Marchandise	Levallois-Perret	Savonnerie	50
Droulers-Vernier	Lille	Filature	400
Delattre père et fils	—	—	220
Lambert-Caillemer	Lisieux	Apprêts et moires	120
Marius Chevallard	Lyon	Ateliers	20
Neyret et Chevallard	—	—	40
Crozier frères	—	Tissage de velours	200
Marge fils et J. Malet	—	Pâtes alimentaires	50
Armand et Pitiot	—	Passementerie	200
Etienne Charbin	—	Tissage de velours	100
Chollet et Rézard	—	—	20^{c}
Buffaud-Robatel	—	Constructeur	20^{c}
Chavant	—	Tissage de velours	50
Ch. Sabatié et C^{ie}	Mazamet	Laines et peaux	128

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Barthas et Bonhomme...	Mazamet......	Fil. de Laines......	17
A. Bru et Cie....... ..	—	Laines et peaux....	17
David Molinier.........	—	Apprêts d'étoffes....	25
Alba Lasource..........	—	Fab. de draps......	60
A. Brasme et Cie... ...	Mazingarbe...	Brasserie..........	17
A. Walcker...........	Méry-s/Oise ..	Art. de voyages....	120
Hyatt et Ward..........	Monville......	Ateliers............	100
Chagot et Cie......... .	Montceau-les-M.	Mines de Blanzy....	17
G. Gerbaud...........	Narbonne.....	Vins......	17
Vve Raynaud et Cie	—	Fab. de carrelages..	27
Marnier-Lapostolle......	Neauphle-le-Ch.	Distillerie..........	17
Pécard..	Nevers........	Constructeur	25
Alb. Menier.....	Neuilly.......	Hôtel part.........	120
Cie de Vicoigne.........	Nœux-les-M...	Mines..............	200
MM. Menier...........	Noisiel........	Chocolaterie........	25
Victor Peters..........	Nomexy	Filature...........	260
Delente et Forget.......	Oisseau.......	Ateliers...........	260
Chevallier frères..	Orléans.... ..	Fab. de couvert^{es}..	17
Dessaux fils.......	—	Vinaigre..........	17
Saintoin frères.........	—	Confiserie..........	17
Cie Fse du Linoléum....	Orly.........	Ateliers...........	100
Vve Th. Held fils, frères et Cie.........	Pau..........	Constr. de machines	17
Agache fils............	Pérenchies....	Filature...	25
J. Bardou et fils......	Perpignan	Papier à cigarettes..	60
Fenal frères...........	Pexonne......	Faïencerie..........	60
H. Petit et Cie.........	Pont-Audmer..	Filature...........	100
Edouard Lefebvre.......	Pont-Authou..	Filature...........	150
Francillon et Cie........	Putaux.......	Ateliers...........	25
Roche-Ponthus...... ...	Régny........	—	17
H. Bailly fils..........	Reims........	Bijouterie.........	25
Anthony, Mœbs et Cie...	Remiremont...	Filature...........	120
Noiret................	Rethel........	Ateliers...........	17
Blanchet frères et Kleber.	Rives........	Papeterie..........	80
Forest et Deschamps....	Roanne.......	Tissage...........	25
Fourt et Cie...........	—	—	200
Chapelet fils..........	Rochefort.....	Usine.............	62
Fonderies.............	Romilly......	—	25
Buisine et Poissonnier ..	Roubaix......	Filature...........	25

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Motte et Blanchot.......	Roubaix.....	Filature..........	50
Ch. Pollet.............	—	—	300
Lemaire et Dilliès......	—	—	500
Motte et Meillasoux.....	—	Teinturerie.........	400
Louis Lefebvre.........	—	Filature...........	300
Auguste Lepoutre......	—	Filature et tissage..	300
Amédée, Prouvost et Cie.	—	Peignage et filature.	150
Motte Bossut fils.......	—	Filature...........	120
Wibaux-Florin..........	—	— ...	60
A. Fahr..............	Rouen........	Usine.............	60
Le « Labrador »........	—	Vapeur...........	50
Davey, Bickford, Watson et Cie..............	—	Mèches pour mines.	50
Evrard et Cie..........	Rue.........	Usine.............	25
Fonderie de l'État......	Ruelle........	Fonderie de canons.	240
Poudrerie de l'État	Saint-Chamas..	Poudrerie.........	60
Société des tresses et lacets	Saint-Chamond	Passementerie......	120
M. Th. Véron....	St-Didier-la-Se.	Fabrique de papiers	
P. Schmitt fils.........	Saint-Dié.....	Filature...........	
Giron frères...........	Saint-Étienne..	Usine.............	60
Chambeyron et Chavanne	— ..	—	25
M. Durafour..........	— ..	—	17
Bessy frères.	— ..	—	25
C. Eugène............	Saint-Maur....	Fabrique de couvert.	17
Poudrerie de l'État.....	Saint-Pouce...	Poudrerie...... ...	
F. Odiaux.............	Saint-Quentin..	Miroiterie.........	17
Trocmé..............	— ..	Tissus de coton....	60
David, Trouiller et Adhémar...............	— ..	—	60
Vaucher et Cie.........	Saint-Sever ...	Filature...........	100
Aimé Baboin..........	Saint-Vallier..	Métiers à tulle......	50
Guillermin et Blanci....	— ..	Filature de soie....	25
Charaire fils...........	Sceaux.......	Imprimerie........	44
Delaune et Cie.........	Seclin........	Distillerie.........	25
Compagnie française du Celluloïd............	Stains.......	Ateliers...........	60
Les Fils de Guillaumet..	Suresnes.....	Teinturerie........	150
Sordes, Huillard et Cie..	—	Ateliers...........	120
Chatelard, père et fils...	Tarare.......	Métiers à mousseline.	50

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Société industrielle pour la Schappe	Tenay (Ain)	Ateliers	50
Blanchisserie	Thaon	Blanchis. et Teintur.	25
Zuber, Rieder et Cie	Torpes	Papeterie	17
Sirven et Ce	Toulouse	—	17
V. Valentin	Tourcoing	Filature	200
Paul Jonglez	—	—	200
Félix Desurmont	—	—	200
Pollet, Caulliez et fils	—	Peignage	600
F. Masurel frères	—	Peignage et filature	400
Caulliez père, fils et Delaoutre	—	—	60
A. Clerget et Cie	Vesoul	Fab. de pâtes alim.	60
École régimentaire du Génie	Versailles	École	25
Pommier jeune et fils	Vienne (Isère)	Ateliers	25
B. Berthelot	Vif (Isère)	Fabrique de ciment	25
Mulsant père et fils	Villefranche (R.)	Filature de coton	120
Étienne Seigle	Villefranche	Minoterie	240
Guérimand et Cie	Voiron	Papeterie	34
Jaubert-Audras et Cie	—	Fabrique de soie	120

BELGIQUE

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
De Smet et Dhanis	Gand	Filature	300
Rey aîné	—	—	60
Rey aîné	Ruysbroeck	—	300
E. L. Godin fils	Huy	Papeterie	60
N. Porta	—	Fonderie	60
Ancion Wauthier	Gingelom	Sucrerie	80
Snyers Baudoin	Rosoux Payer.	—	80
Zaman	Limal	Papeterie	80
Charbonnages du Boubier	Chatelet	Charbonnage	60

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Charbonnages du Bascoup	Bascoup	Charbonnage	120
Philipps Glazers	Termonde	Couvertures coton	114
Janssens de Decker	Saint-Nicolas	Filature	70
Beliard et Best	Anvers	Constructeurs	17
Brou	Monceau	Haut fourneau	80

ALLEMAGNE

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Gazette de Cologne	Cologne	Gazette	181
Röschke et Buschkiel	Zittau	Électriciens	17
V. Vogel	Munich	Brasserie	60
Gare centrale	Strasbourg	Gare	2000
Van der Heydt	Elberfeld	Particulier	120
Chantier de la marine impériale	Dantzig	Chantier	120
Gouvy frères et Cie	Hombourg ht.	Filature	80
S. Lindauer et Cie	Cannstadt	Fab. de corsets	130
Ungerer et Schulze	Strasbourg	Électriciens	17
Emile Ascherberg	Dresde	Fab. de pianos	250
G. Schaeffer	Gœppingen	Électricien	17
Gebr. Lœvy	Passau	Magasin	17
Geo. Andres	Creuznach	Fabrique de cuirs	17
W. Hepner	Gœrlitz	Négociant	17
John Pet. Schneider	Neuwied	Filature	28
C. Durkopp	Bielefeld	Fab. de machines à coudre	34
Fabrique de sucre	Rositz	Sucrerie	250
Brasserie Bohémienne	Berlin	Brasserie	60
Fisher et Seige	Pœsneck	Tissage	138
Residenz Theatre	Munich	Théâtre	750
Schaeffer et Hauschner	Berlin	Fab. de lustres	17
Berghausen et Ce	Cologne	Société électrique	214
Norddeutsche Affinerie	Hombourg	Affinerie	17
Spiecker et Cie	Cologne	Électriciens	17
Rosenfeld et Ce	Berlin	Fab. de linoleum	78

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Dannenbaum frères	Warrenton	Fabrique de sucre	60
Fabrique de papier	Coswig	Papeterie	76
Usine à gaz	Berlin	Gaz	60
Sucrerie	Ahrensbeck	Sucrerie	150
Siechen	Berlin	Restaurant	60
A. Hoffmann	Neugersdorf	Filature	17
Sucrerie	Neustadt	Sucrerie	150
Sucrerie	Güstrow	—	120
Union club	Berlin	Club	120
Ressource	—	—	120
Goerne et Cie	Ahlen	Mines strontianite	60
J. Neuhauss Nachfolger	Crefeld	Teinturerie	47
Fr. Buch	Werden	Usine	17
Pfankuch et Reinhardt	Cologne	Électriciens	32
Aders	Magdebourg	Fabrique de cuivre	60
Peydel et Naumann	Dresde	Mach. à coudre	60
W. Schrœder	Crefeld	Tissage	17
Mohring	Francfort	Constructeur	120
Université	Rostock	Laboratoire	17
Théâtre-Royal	Stuttgart	Théâtre	160
— —	Dresde	—	150
Villeroy et Boch	Schamberg	Fab. de majolica	60
H. Simon	Zweibrücken	Tissage de soie	120
J.-P. Nicolaï	Calbe	—	120
Sucrerie	Papenteich	Sucrerie	200
E. Lehmann	Gr. Gastrose	Moulin	25
Sucrerie	Twulpsterl	Sucrerie	120
E.-L. Kummer	Dresde	Electricien	17
Papeterie	Wesbad	Papeterie	60
Lehmann	Restaurant	Berlin	60
Iüss et Crotogino	Rostock	Chantier	60
L. Schuckert	Nuremberg	Electricien	100
Ferd. Gröer	Neufra	Filature	17
Lloyd	Bremerhaven	Vapeur « Werra »	300
Chen-Juen		Cuirassé chinois	150
Sucrerie	Mellin	Sucrerie	250
L. Spindler	Berlin	Teinturerie	100
Station-Centrale	—	Station centrale	500
C. Kissling	Breslau	Restaurant	50

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
A. Bielschowosky	Breslau	Moulin	100
Hartmann et fils	Minster	Filature	100
Arsenal	Spandau	Laboratoire	100
Sucrerie	Zulz	Sucrerie	100
Geber Falkenberg fils	Custrin	Moulin	25
Usine élévatrice	Lübeck	Elévateur	60
G. de Kramsta	Frankenthal	Château	150
Tissage de Velours	Berlin	Tissage	100
Sucrerie	Hasede	Sucrerie	200
Ld. et G. Kochlin	Weiler	Filature	50
Sucrerie	Melno	Sucrerie	200
F. Kiesekamp	Munster	Moulin	50
Grand Hôtel	Berlin	Hôtel	200
Sucrerie	Riesenburg	Sucrerie	150
C. Strauss	Schwerin	Restaurant	120
Sucrerie	Lbeleben	Sucrerie	100
A. Motard et Cie	Berlin	Fabrique de bougies	150
Mines “ Ste-Cécile „	Silésie	Mines	200
Scholler	Breslau	Filature	200
Jacques Schiesser	Radvefzell	Fabrique de tricot	150
Beerenson et Oldroyd	Sazan	— drap	500
Café Roth	Munich	Café	50
Grunebaum et Kaufmann	Cottbus	Fabrique de drap	200
Hartmann et fils	Munster	Filature	900
Hôtel de Ville	Breslau	Bureaux	100
Sucrerie	Warburg	Sucrerie	100
Station centrale	Berlin	Station centrale	1800
Benfeld	Huttenheim	Filature	25
C. Dunklenberg	Elberfeld	Villa	25
Comte Stollberg	Buckau	Fabriq. de machines	100
Fr. Rottmann	Burgsleinfurt	Fabrique de tabac	50
Schramm fils	Bromberg	Moulin	50
Duch et Hamann	Cottbus	Fabrique de drap	100
Plaut et Schreiber	Jessnitz	Imprimerie	17
I. Bannert	Langenon	Moulin	50
Mayer Loevy frères	Passau	Usine	50
Bankverein	Barmen	Banque	50
E. Kayser	Cologne	Bronzes	50
Schleipen et Erkens	Julich	Papeterie	50

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Société des Moulins	Duisburg	Moulin	100
E. et K. Schneider	Breslau	Bureaux	100
Jacob Landau	Berlin	Banque	100
Sucrerie	Uelzen	Sucrerie	200
Hôtel de Ville	Berlin	Salles et bureaux	400
Sucrerie	Freitstedt	Sucrerie	600
Théâtre royal	Munich	Théâtre	2500
C. Comberg	Elberfeld	Bronzes	50
Poudrerie	Spandau	Poudrerie	200
M. et H. Magnus	Konigsberg	Menuiserie	50
F. Reinwen	Hambourg	Bazar	200

AUTRICHE-HONGRIE

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
R. Auspitz et Cᵉ	Rohatez	Sucrerie	350
Graf St. Genois	Czellechowitz	—	110
H. Frey	Vysocan	—	150
Elbogen et Fritsch	Schönpriesen	—	150
S. Moses Loew. Beer	Brunn	Fabrique de draps	260
Sigmund Schwarz	—	Filature	270
J. Hukel's Söhne	Neutitschein	Fab. de chapeaux	80
Ringhoffer et Cᵉ	Prag		300
Maschinenbau. Act. Ges.	—	Constructeurs	250
Stadttheater	Brünn	Théâtre	1060
Böhm. Nationaltheater	Prag	—	3150
A. Munk et Söhne	Slatina	Selerie	50
Graf Kinsky	Stryj	—	30
Hanna Malzfabrik	Kremsier	Fabrique de malte	160
Baron Steinheil	Chutoroc	Ateliers	60
Wiener Tagblatt	Wien	Imprimerie	240
Union-Baugesellschaft	—	Café	440
Schoeller et Cᵉ	Léva	Moulin	60
Schoeller et Cᵉ	Czakowitz	Sucrerie	320
Fr. Redlich	Brünn	Tissage	380
H. Pisko	—	Filature	120

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Böhm. Bodencredit Anstalt	Prag	Banque	120
Aug. Matthey	Graz	Imprimerie	120
Techn. Gewerbe Museum	Wien	Salles de dessin	30
Cotonificio Triestino	Triest	Filature	260
Schoeller Gebruder	Brünn	Fabrique de draps	30
K. D. Wolf	Rumburg	Ateliers	30
J. Budig	Zwittau	Filature	120
Sucrerie	Yschul	Sucrerie	106
Fr. Woegerer	Pilmikan	Filature de soie	140
Darblay père et fils et Beranger	Worgl	Fab. de cellulose	100
Concordia	Budapest	Moulin	250

ITALIE

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Municipio di Milano	Milan	Théâtre	2890
Societa del Teatro Manzoni	—	—	367
Societa dell' Unione	—	Club	75
Societa Patriottica	—	—	180
Circolo Industr. e Commerc	—	—	43
Signori Legnani, Marini e C.	—	Hôtel Continental	475
Sig. Chierichetti	—	Café Cova	284
» Colombo	—	Café Accademia	39
» Casanova	—	Brasserie	73
Fratelli Bocconi	—	Négociants	133
Sig. Bai	—	Confiseur	91
» Laforêt	—	Fabrique de gants	25
» Thonet	—	Fabrique de meubles	21
» Introvini	—	Horlogerie	18
» Calderoni	—	Bijouterie	20
» Finzi	—	Bonneterie	13
» Motta	—	Bijouterie	8
» Zamoni	—	Parapluies	7

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Sig. Monti e Nava	Milan	Droguerie	6
» Pettinaroli	—	Papeterie	4
» Gamond	—	Agence	7
» Franceschi	—	Horlogerie	6
» Carlo Erba	—	Pharmacie	8
» Carlo Erba	—	Produits chimiques	17
» Nicolesco	—	Appartements	18
» Ricordi	—	Merch. de musique	20
» M. Bonino e figlio	—	Bijouterie	10
» Cusiraghi	—	Chapellerie	9
» Ronchetti	—	Parapluies	5
» Ferrario	—	Bijouterie	8
» Vitali	—	Appartements	4
» Rizzi	—	Objets d'art	5
» Vercesi	—	—	10
» Capretti e C	—	Café Biffi	92
» Aliprandi	—	Café Maczonia	7
» Finzi	—	Bonneterie	8
» Giachi	—	Appartement	13
» Caldercni	—	Bijouterie	9
» Celada	—	Confiserie	10
» Oriani	—	Lingerie	12
» Bonomi	—	Droguerie	3
» Biraghi e Longa	—	Bonneterie	10
» Franzetti	—	Poteries	22
» Pietrasanta e C.	—	Quincaillerie	15
» Belotti	—	Modes	16
» Carabelli	—	Pâtisserie	15
» Duroni e C.	—	Instr. de physique	9
» Mosca	—	Modes	8
Credito Lombardo	—	Banque	12
Banca generale	—	—	60
Sig. Comizzoli	—	Café	16
A. ed A. Ponti	Solbiate Olona.	Filature	120
Benigno Crespi	Canonica	—	267
Giuseppe Crespi e C°	Vigevano	—	180
Giacomo Nissim	Pisa	Tissage	305
Crespi è C.	Nembro	Filature	118
Fratelli Cassanello	Pegli	Moulin	60

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
A. M. Crosti	Nebbiuno	Filature	15
Leumann e C°	Torino	—	120
Scerno Gismondi e C°	Sampierdarena	Huilerie	15
Bodmer e C.	Napoli	Moulin	80
Amman e Wepfer	Pordenone	Filature	58
A. Traxler	Livorno	Villa	30
G. Monti	Tenzanico	Filature	16
Società A. Fornaci	Picci	Haut fourneau	26
Canapificio Veneto	Treviso	Filature	150
Cotonoficio Veneziano	Venezia	—	502
Stabilimenti Pietrarsa e Granili	Napoli	Atelier mécanique	400
L. Bontempelli	Roma	Ateliers de titres	15
Officina Galileo	Firenze	Inst. de physique	60
Pigni e Schwarzenbach	Baveno	Filature	58
L. Rapuzzi e C.	Cremona	Moulin	40
Ermanno Mosters	Somma Lomb.	Filature	100
Lombardi Vietti e Ricchiardi	Roma	Moulin	18
Cav. G. Susani.	Besana	Filature	50
Wild e abegg	Borgone	—	300
Tito di Gio. Ricordi	Milano	Atelier de musique.	100
Societa del Gaz	Roma		180
Fratelli Melchior	Vicenza	Café	70
Antonio Oltolina	Asso	Tissage	60
Rafaele Arena	Caserta	Moulin	60
Cavalieri e Franco	Bologna	—	250
Municipio di Torino	Torino	Théâtre	450
Compagnia Raggio	Genova	Bâteau « Sirio »	177
— —	—	— « Verseo »	177
— —	—	— « Orione »	177
Pia e Ra	Blandizzo	Moulin	85
Société des Eaux pour l'Étranger	Venezia	Distribution d'eau	17
Fratelli Crespi e C°	Ghemme	Filature	82
G. Crespi e C.	Vigevano	Tissage	200
Fratelli Cassanello fu Pietro	Legli	Moulin	44
Cotonifizio Veneziano	Venezia	Filature	360

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
Gioachino Zopfi	Kanica	Tissage	140
Enrico Giovanni	Torino	Ateliers de mécanique	47
Linificio e Canapificio Nazionale	Fara d'Ydda	Filature	225
Durini conte Giulo	Gorla Minore	Tissage	50
Regia Marina	Napoli	Yacht « Savoia »	360
—	—	Bateau « Italia »	850
—	—	— « Dandolo »	400
Morteo Gianolio e C°	Cantalupo	Huilerie	65
Francesco Cervetto	Pontedicimo	Moulin	18
Amman e Wepfer	Pordenone	Filature et Tissage	200

ESPAGNE

Gouvernement	La Carraca	Arsenal	500
Gouvernement	Carthagena	—	150
Labrador	Madrid	Usine	44
Gozalvez é hijos	Villalgordo	—	70

HOLLANDE

Krasnopolski	Amsterdam	Café	68
J. Reynvaan (de Weischsel	—	Minoterie	78
Wester Suckerraffinadery	—	Sucrerie	378
Spakler et Tetterode	—	—	145
Nygh et Zoon	Rotterdam	Imprimerie	84
De Pesters Kooy et C°	Amsterdam	Brasserie	16
Leesmuseum	—	Salle de lecture	60
Wester Suckerraffinadery	—	Sucrerie	17
C. A. Spin et Zoon	—	Imprimerie	24
C. W. Schonebaum	Groningen	Tissage	60
Station centrale	Amsterdam	Station centrale	1000

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES

RUSSIE

Caucas et Mercur	S. Volga	Steamer	80
Alferaki	Taganrog	Moulin	80
Hutcheson et C°	Moscou	Filature	310
Chemin de fer	Konotop	Gare	120
Dembitzky	Okoulowka	Fabrique de sacs	60
Melzer	Cronstadt	Fabr. de meubles	62
Kœning	St-Pétersbourg	Raffinerie	17
Goujon	Moscou	Filature	60
Cie Ingerois	Ingerois	Papeterie	60
Ricks	Helsingfors	—	60
Johnson	Yveshylä	Scierie	17
Finlayson et Cie	Tammerfors	Filature	800
Arppès	Wortzilä	Moulin	17
Cie Josefow	Josefow	Sucrerie	290
Bormann et Cie	Varsovie	—	17
Smichdt	Riga	Fabrique de ciment	20
Caucas et Mercur	Astrachan	Atelier	60
L. Knopp	Moscou	Filature	250
A. Bede	—	Usine	34
G. Liszt	—	—	200
Etremoff	St-Pétersbourg	Moulin	34
G. Liszt	Moscou	Constructeur	120
Wawelberg	Varsovie	Banque	60

DANEMARK

A. Borchorst	Copenhague	Fabrique de liqueurs	15
Kemp et Lauritzen	—	Électricien	25

NOMS	VILLES	NATURE DES LOCAUX	NOMBRE de LAMPES
SUÈDE			
Palais du Roi....	Stockholm	Palais.............	100
ROUMANIE			
Théâtre.....	Bucharest.....	Théâtre...........	1500
Ephorie	—	Bains.............	750

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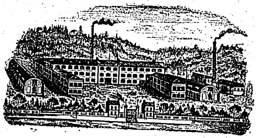


USINE A IVRY-SUR-SEINE

Societe Industrielle & Commerciale Edison [not filmed]

This folder contains printed material issued by the Societe Industrielle & Commerciale Edison. Organized in Paris on February 17, 1882, this company manufactured electrical equipment for European markets.

The following item has not been filmed: "Statuts" (1883). An English translation can be found in D-82-038 (Document File Series).

Deutsche Edison Gesellschaft

This folder contains printed material issued by Deutsche Edison Gesellschaft. Organized in 1883, this company marketed the Edison system of electric lighting in Germany.

The following items have been filmed:

1. "Das Edison-Gluehlicht . . ." (1883)
2. "Elektrische Beleuchtung von Theatern . . ." (1884)

The following item, also found in D-83-037 (Document File Series), has not been filmed:

"Memorandum of Agreement" [incorporation papers] (1883)

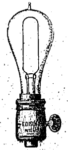
VERÖFFENTLICHUNG
DER
DEUTSCHEN EDISON GESELLSCHAFT.
I.

DAS

EDISON-GLÜHLICHT

und seine Bedeutung für

Hygiene und Rettungswesen.



BERLIN.
Verlag von Julius Springer.
1883.

DAS

EDISON-GLÜHLICHT

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Hygiene und Rettungswesen.

BERLIN.
Verlag von Julius Springer.
1883.

INHALT.

Entspricht die künstliche Beleuchtung unserer Wohnräume, der Schulzimmer und Hörsäle, der Theater, der Concerthallen, der Fabriken und aller der Räume, in denen sich zeitweilig viele Menschen aufhalten, den Anforderungen der heutigen Gesundheitspflege?

Nein! —

Die geographische Lage der Länder, welche als Culturstaaten die Führung haben, bedingt die Zunahme der dunklen Tageszeit in den Herbst- und Wintermonaten und zwingt die Culturvölker zur ausgedehnten Anwendung der künstlichen Beleuchtung, damit auch der Theil des Tages ausgenutzt werden kann, welchen die früh eintretende Dunkelheit der Arbeit entzieht.

Nur durch die Verlängerung des Tages durch künstliche Beleuchtung ist das rasche Aufblühen der Cultur möglich geworden, ebenso wie ihre Entwicklung gleichen Schritt mit den Verbesserungen auf dem Gebiete des Beleuchtungswesens hält. Eine Rückkehr zu der Beleuchtung, wie sie im Anfang dieses Jahrhunderts gebräuchlich war, wäre gleichbedeutend mit einem Rückschritt in der Cultur.

Das Lichtbedürfniss hat sich allmälig gesteigert und dem Verlangen nach vermehrter Helligkeit ist durch die jetzt allgemein gewordenen Arten der Beleuchtung Rechnung getragen. Gleichzeitig aber hat die Vermehrung und Verstärkung der Lichtquellen Uebelstände im Gefolge, welche die moderne Gesundheitslehre auf Grund streng wissenschaftlicher Untersuchungen feststellte. Es sind dies: die Verderbniss der Luft in geschlossenen Räumen durch Erwärmung und durch Zufuhr von schädlichen Produkten der Verbrennung, sowie der nachtheilige Einfluss der gebräuchlichen Lichtquellen auf die Augen.

I.

Beleuchtung und Luftverderbniss.

Die Ueberhitzung geschlossener Räume durch Gasflammen ist eine zu bekannte Thatsache, als dass sie mehr als eines Hinweises bedürfte. Nur mag hier darauf aufmerksam gemacht werden, dass der Aufenthalt in solchen überhitzten Räumen und der Austritt in das Freie, namentlich im Winter, den menschlichen Organismus einem Wechsel von Temperaturunterschieden aussetzen, der in häufigen Fällen die Veranlassung zu Erkältungen und Krankheiten wird. Eine ganze Reihe der Winter-Siechthümer muss der hohen Temperatur zugeschrieben werden, welcher der Mensch in den zwar genügend erhellten, aber zugleich überhitzten Räumen zeitweilig sich aussetzt. Unsere Theater, unsere Concertsäle, die Lokalitäten der Restaurants, der Cafés und der Bierhäuser, wie nicht minder die Gesellschaftsräume der Privathäuser, leiden sammt und sonders an Ueberhitzung der Luft durch die gebräuchliche künstliche Beleuchtung, welche daher den hygienischen Anforderungen der Jetztzeit in dieser Beziehung keineswegs entspricht. Die Erfahrung jedes Einzelnen wird das eben Gesagte bestätigen.

Nicht minder schädlich als die zu starke Erwärmung der Luft in geschlossenen Räumen ist die Verderbniss derselben durch die Verbrennungsprodukte, welche jede Flamme, einerlei ob Kerzen-, Oel-, Petroleum- oder Gasflamme, unausgesetzt entwickelt.

In erster Linie kommt die Kohlensäure in Betracht, die überall entsteht, wo Verbrennungen stattfinden und die nicht nur von den zur Beleuchtung dienenden Flammen erzeugt wird, sondern auch von dem Menschen, der, so lange er athmet, einen Verbrennungsprocess unterhält und mit jeder Ausathmung Kohlensäure aushaucht. In einem mit Menschen gefüllten und durch viele Flammen erleuchteten Raume wird daher die Luft insofern verschlechtert, als Menschen und Flammen derselben Sauerstoff entziehen, den sie in Kohlensäure umsetzen, welche der Luft zurückgegeben wird.

Dazu kommt, dass beide, sowohl Menschen, wie Flammen zur Steigerung der Temperatur beitragen, da auch der Mensch fortwährend einen Theil der in seinem Organismus erzeugten Wärme an seine Umgebung abgiebt.

Das Unwohlbefinden mancher Personen in geschlossenen, überfüllten und überhitzten Räumen, welches sich von unverkennbarem Unbehagen, bis zur wirklichen Ohnmacht je nach der Constitution des Einzelnen steigern kann, hat seine Ursache in der künstlichen Beleuchtung. Die Luft der Arbeitssäle, in denen viele Flammen brennen, ist oft derart, dass sie schädigend auf die Gesundheit der Arbeiter einwirkt, ihnen die Spannkraft nimmt, welche ihre Thätigkeit erfordert, und sie elend macht. Dasselbe gilt von Hörsälen und anderen Versammlungsorten und somit ergiebt sich, dass die Arbeit, das Ringen nach Wissen und Erkenntniss und selbst die Erholung, welche Kunst und gesellige Vereinigung gewähren sollen, insofern als sie des durch die übliche künstliche Beleuchtung verlängerten Tages bedürfen, mit Aufopferung des Wohlbefindens und gar häufig der Gesundheit erkauft werden müssen.

Zur Abhülfe dieser Uebelstände ist seit langer Zeit die ausreichende Zufuhr von frischer Luft durch Ventilation vorgeschlagen worden. Es hat sich aber herausgestellt, dass eine ausreichende Ventilation ungemeine Schwierigkeiten darbietet und dieselbe nur durch maschinelle Einrichtungen erzielt werden kann, welche mit Kosten verbunden sind, wesshalb dieselben bis jetzt nur in einigen Theatern und ähnlichen Zwecken dienenden Lokalen gefunden werden.

Ganz anders und vortheilhafter gestalten sich jedoch die Verhältnisse, wenn geschlossene Räume durch Lichtquellen erleuchtet werden, welche nur geringe Wärme entwickeln und weder Sauerstoff verbrauchen, noch der Luft Verbrennungsprodukte zuführen. Alsdann ist es auch möglich, durch verhältnissmässig einfache Ventilationsvorkehrungen den erforderlichen Luftwechsel zu bewerkstelligen und nach dieser Richtung hin den Anforderungen der Hygiene Rechnung zu tragen.

Eine Beleuchtung, welche die eben genannten Vortheile bietet, liefert das elektrische Glühlicht.

Ehe wir demselben unsere specielle Aufmerksamkeit widmen und seiner anderweitigen Vorzüge gedenken, ist es nothwendig, den Einfluss der gebräuchlichen Beleuchtungsarten auf die Luft hinsichtlich der Erwärmung und der Verunreinigung zu betrachten. Bemerkt sei noch, dass unter dem Ausdruck „Calorie" diejenige Wärmemenge zu verstehen ist, welche einem Kilogramm Wasser zugeführt werden muss, um dasselbe um einen Grad Celsius zu erwärmen. Eine Calorie gilt als Wärmeeinheit.

Indem die verschiedenen Lichtquellen in Bezug auf die von ihnen entwickelte Kohlensäuremenge und Wärmeeinheiten (Calorien) verglichen werden, erhält man einen Massstab für ihren mehr oder minder schädlichen resp. günstigen Einfluss im Sinne der Hygiene, nach deren Lehre bereits die Luft als ungesund gilt, welche mehr als 0,0007 oder 0,001 Kohlensäure enthält. Die durch den Lebensprocess erzeugte Kohlensäure beträgt bei einem erwachsenen Manne ungefähr 20 l, während ein gewöhnlicher Gasbrenner von 8—10 Normalkerzen Leuchtkraft etwa 80 l entwickelt, so dass eine einzige Gasflamme gegen viermal soviel Sauerstoff verbraucht und Kohlensäure liefert als ein Mensch. Ein durch hundert solcher Gasflammen erleuchteter Raum ist daher so zu betrachten, als wenn sich vierhundert Menschen in demselben ohne Beleuchtung aufhielten, und rechnet man die Gasflammen in kleinen Sälen und Zimmern in gleicher Weise als Personen aus, so ist man nicht nur im Stande, sich ein annäherndes Bild von dem Luftverbrauch und der Luftverderbniss zu machen, sondern wird finden, dass die meisten Gesellschaftsräume bei starkem Besuche meistens überfüllt sind, wenn die Zahl der Gasflammen mit vier multiplicirt und als athmende Menschen betrachtet, der Zahl der anwesenden Personen hinzu addirt wird.

In ähnlicher Weise verhalten sich die übrigen Beleuchtungsarten, mit Ausnahme des elektrischen Glühlichts. Die für dieselben erforderlichen Luftmengen, welche zugeführt werden müssen, wenn der Grenzwerth der Kohlensäure von 1 pro Tausend nicht überschritten werden soll, sind aus den folgenden Resultaten*) genauer Untersuchungen ersichtlich.

1) Kerzenbeleuchtung. Eine Stearinkerze, welche in der Stunde 11 gr verbraucht und 15 l Kohlensäure entwickelt,

*) Breymann-Scholtz, Allgemeine Bau-Constructions-Lehre IV. Theil 1881. S. 215.

bedarf stündlich einer Zuführung von 30 cbm Luft. Es werden ungefähr 106 Calorien entwickelt, welche das erforderliche Ventilationsquantum von 30 cbm um 12,4 Grad erwärmen.

2) Gasbeleuchtung. Ein Flachbrenner von 10 Normalkerzen Lichtstärke verbraucht stündlich 127 l Gas, wobei 86 l Kohlensäure erzeugt werden. Diese 86 l benöthigen 172 cbm Luft. Durch den Brenner werden stündlich 865 Calorien erzeugt, welche die einzuführende Luftmenge um 17,9 Grad erwärmen.

3) Elektrische Bogenlicht-Beleuchtung. Nach den Angaben von Fontaine verbrennen bei einer elektrischen Bogenlichtlampe, welche ein gleichmässiges Licht von der Stärke von 100 Schnittbrennern giebt, stündlich 5 cm Kohlenstäbe von 1 qcm Querschnitt. Es werden also im Maximum 12 gr oder ungefähr 22 l Kohlensäure erzeugt, so dass stündlich nur 44 cbm Luft hinzugeführt zu werden brauchen.

4) Elektrisches Glühlicht. Da bei dieser Beleuchtung nicht durch einen verbrennenden, sondern vielmehr durch einen glühenden, in einer Glasglocke luftdicht eingeschlossenen Körper (Kohlenbügel) das Licht entsteht, so findet eine Erzeugung von Kohlensäure nicht statt, und ist daher eine Luftzuführung für die Beleuchtung in diesem Falle überhaupt nicht erforderlich. Ferner ist die Wärmeentwickelung der Glühlampen eine ausserordentlich geringe. Bei einer stündlichen Erzeugung von 100 Normalkerzen durch Glühlicht werden nur 290—536 Calorien — dagegen durch einen gewöhnlichen Gasbrenner 12 150 Calorien — entwickelt.

Vorstehende Zahlen beweisen hinsichtlich des Einflusses der künstlichen Beleuchtung auf die Luft in geschlossenen Räumen schlagend die Ueberlegenheit der elektrischen Beleuchtung, speciell der Glühlichtbeleuchtung. Bei letzterer findet

eine Entwicklung von irgend welchen Gasen überhaupt nicht statt, und erwärmen sich die Lampen so wenig, dass man sie bequem nach einigen Stunden Brenndauer mit der Hand anfassen und sogar in Wasser tauchen kann, ohne dass sie zerspringen. Die geringe Wärmeentwickelung der Glühlampen hat auch Prof. Dr. Weinhold in Chemnitz durch einen sehr interessanten Versuch nachgewiesen. — Er benutzt zu demselben einen Streifen Papier, welcher mit einem Anstrich von Jodkupferquecksilber versehen ist. Diese, bei gewöhnlicher Temperatur hellrothe Substanz färbt sich bei Erwärmung auf 60—70° C. dunkelbraun und wird bei Abkühlung wieder roth, wenn sie nicht zu weit über die genannte Temperatur erhitzt wurde. Wickelt man nun diesen Streifen um eine brennende Glühlampe, so wird er langsam braun und nach dem Abnehmen sofort wieder hellroth, während eine kurze Berührung mit dem Cylinder der Gaslampe hinreicht, den Farbstoff dauernd zu zerstören und eine längere Berührung, selbst das Papier zu verkohlen.

Zu dem vorliegenden Capitel hat Dr. Ferdinand Fischer aus Hannover anlässlich der am 16.—19. Mai d. J. stattgehabten Sitzungen des Vereins für Gesundheitstechnik und des Vereins für öffentliche Gesundheitspflege höchst werthvolle Beiträge*) geliefert. Derselbe hat mit 16 verschiedenen Beleuchtungsarten eingehende Versuche angestellt und für jede den erforderlichen Kraft- bezw. den Materialbedarf, die erzeugte Menge an Wasser, Kohlensäure und Wärme bestimmt und aus den gefundenen Zahlen die nebenstehende höchst interessante Tabelle zusammengestellt.

*) Dingler's Journal 1883 Bd. 248 S. 375.

Für die stündliche Erzeugung von 100 Kerzen sind erforderlich:		Dabei werden entwickelt:		
Beleuchtungsart	Menge	Wasser k	Kohlensäure cbm b. 0°	Wärme-Calorien
Elektr. Bogenlicht	0,09—0,25 Pferdest.	0	0	57—158
„ Glühlicht	0,46—0,85 „	0	0	290—536
Leuchtgas, Siemens' Regenerativlampe	0,35—0,56 cbm	—	—*)	etwa 1500
Leuchtgas, Argandbrenn.	0,8 cbm (—2)	0,86	0,46	4860
„ Zweilochbr. .	2 cbm (—8)	2,14	1,14	12150
Erdöl, grosser Rundbrenn.	0,28 kg	0,37	0,44	3360
„ klein. Flachbrenn.	0,60 „	0,80	0,95	7200
Solaröl, hygien. Lampe von Schuster & Baer .	0,28 „	0,37	0,44	3360
Solaröl, kleiner Flachbrenner	0,60 „	0,50	0,95	7200
Rüböl, Carcellampe . . .	0,43 „	0,52	0,61	4200
„ Studirlampe	0,70 „	0,85	1,00	6800
Paraffin	0,77 „	0,99	1,22	9200
Walrath	0,77 „	0,89	1,17	7960
Wachs	0,77 „	0,88	1,18	7960
Stearin	0,92 „	1,04	1,30	8940
Talg	1,00 „	1,05	1,45	9700

*) Bei den Siemens'schen Regenerativbrennern werden die entwickelten Gase nach aussen abgeführt und kommen daher hier nicht in Betracht.

Aus den Angaben dieser Tabelle ersieht man zahlengemäss, wie wenig gerade die jetzt allgemein gebräuchliche Beleuchtungsart nämlich die Gasbeleuchtung, im Einklang mit den berechtigten Forderungen der Hygiene steht.

Diese Uebelstände, welche schon längst deutlich empfunden wurden, bevor sie durch Männer der Forschung wissenschaftliche und unwiderlegliche Begründung erhielten, drängten auf eine Reform des Beleuchtungswesens, das eine zu wichtige, zu einschneidende Rolle in unserm gesammten Culturleben spielt, als dass ihm nicht von den verschiedensten Seiten, sowohl von der geschäftlich praktischen, als von der hygienischen Aufmerksamkeit geschenkt werden musste, und veranlassten Theoretiker und Praktiker nach einem neuen Beleuchtungsmittel als Ersatz für das Gaslicht zu suchen, welches wohl die Tugenden, nicht aber die Nachtheile des letzteren besässe. Aus dieser Erkenntniss thatsächlicher Missstände erklären sich die vielfachen Bestrebungen, dem elektrischen Lichte Eingang zu verschaffen.

Edison, der geniale Amerikaner, war es, der sich die Aufgabe stellte, ein elektrisches Licht herzustellen, das nicht durch blendenden Effekt das Gaslicht übertrumpfen, sondern als Ersatz des Gaslichtes, dasselbe durch eine Reihe von Vorzügen übertreffen sollte, die in der leichten Handhabung, der geringen Wärmeentwicklung, gänzlichem Ausschluss von Sauerstoffverbrauch und Erzeugung von Verbrennungsgasen und in der Vermeidung von Feuersgefahr bestehen.

Trotz unüberwindlich scheinender Schwierigkeiten, trotz jener Verhöhnung, mit welcher die Oberflächlichkeit jedem grossen und neuen Gedanken entgegentritt, liess Edison sich nicht irre machen, sondern gelangte zu dem selbstgesteckten Ziele, zu der praktisch nicht nur möglichen, sondern thatsächlich Vortheile und Vorzüge bietenden elektrischen Beleuchtung mittelst Glühlampen.

Es gelang ihm die Theilung des elektrischen Stromes in erwünschter Weise, die Speisung der Lampen mit Elektricität von Centralstellen, die einfachste Construktion der Lampen und die vortheilhafteste Umwandlung der mechanischen Kraft in elektrische, so dass die Beleuchtung mit elektrischen Glühlampen sich von Tag zu Tag mehr Bahn zu brechen vermag.

Schon allein der Umstand, dass die Glühlampe, deren goldiges, klares Licht das der Gasflamme an Schönheit übertrifft, keine Verbrennungsgase liefert, weder das giftige Kohlenoxydgas noch schweflige Säure- und Schwefelwasserstoffgas, welche letzteren z. B. die Farben werthvoller Stoffe zerstören und Metallwaaren schwärzen, geben dem Glühlichte zur Beleuchtung von Läden und Magazinen den Vorzug vor dem Leuchtgase, dessen freiwilliges Ausströmen ausserdem schon oft zu Vergiftungen mit tödtlichem Ausgange Veranlassung gab. Es hat sich die Glühlichtbeleuchtung in Theatern und Sälen bereits vorzüglich bewährt, wie aus dem folgenden Gutachten vom Prof. von Pettenkofer, mit besonderem Bezug auf die Hygiene, hervorgeht.

HYGIENISCHES INSTITUT
der
kgl. Ludwig-Maximilians-Universität.
München.

Betreff: Beleuchtung des kgl. Residenztheaters in München mit Gas und mit elektrischem Licht.

Bei den auf Ihren und des Herrn Professors Dr. Ernst Voit Wunsch im königl. Residenztheater dahier vom hygienischen

Institute vorgenommenen vergleichenden Untersuchungen zwischen Gasbeleuchtung und elektrischer Beleuchtung wurde die Temperatur und der Kohlensäuregehalt der Luft gleichzeitig im Parket, im I. und im III. Range (Gallerie) ermittelt, und wurden diese Bestimmungen sowohl bei leerem Hause, als auch während Theatervorstellungen vorgenommen.

Ich kann vorerst nur auf die Resultate der Temperatur-Beobachtung bei beiden Beleuchtungsarten Gewicht legen. Die Kohlensäurebeobachtungen haben namentlich bei besetztem Hause ein Resultat ergeben, dessen Constatirung noch eine grössere Anzahl von Versuchen und an mehreren Punkten des Theaters erheischt.

Bei leerem Hause waren nie mehr als 10 bis 15 Personen auf der Bühne und im Zuschauerraum zugegen, der Vorhang blieb offen, und wurde sowohl die Bühne als auch der Zuschauerraum über 1 Stunde lang in voller Beleuchtung erhalten. Die Temperatur wurde an den genannten drei Stellen von 5 zu 5 Minuten beobachtet.

Bei besetztem Hause waren nach Ausweis der Theaterkasse jedesmal zwischen 500 und 600 Personen im Zuschauerraume anwesend, und wurden die Thermometer von 10 zu 10 Minuten beobachtet.

Die Temperatur stieg sowohl bei leerem, als auch bei besetztem Hause vom Minimum am Anfang mit ganz unbedeutenden einzelnen Gegenschwankungen bis zum Maximum am Ende, und finden sich die Zahlen und die Differenzen zwischen Maximum und Minimum in beifolgender Tabelle (s. Seite 16) angegeben.

Es geht daraus zur Evidenz hervor, wie verhältnissmässig wenig die Luft durch die elektrische gegenüber der Gasbeleuchtung erhitzt wird. Selbstverständlich ist der Unterschied bei leerem Hause am grössten; bei besetztem Hause kommen neben der von den Zuschauern und Mitspielenden entwickelten Wärme noch mancherlei Störungen vor. Der Zuschauerraum ist vor Beginn der Vorstellung voll beleuchtet, die Bühne nicht; während des Aktes wird die Beleuchtung des Zuschauerraums sehr reducirt und die auf der Bühne nach Bedürfniss gesteigert; im Zwischenakte ändert sich das Verhältniss wieder ins Gegentheil um, und lassen sich diese Umänderungen quantitativ nicht gut verfolgen.

Zum genaueren Vergleich eignen sich daher streng genommen nur die Resultate bei leerem Hause, wo während der Versuchsdauer an der Stärke der Beleuchtung der Bühne und des Zuschauerraums nichts geändert wurde und der Vorhang immer aufgezogen blieb.

Aus diesen Versuchen sieht man, dass bei leerem Hause die Differenz in der Temperaturerhöhung im obersten Range bei Gasbeleuchtung 10 Mal (9,2 : 0,9) grösser ist als bei elektrischer Beleuchtung. In den unteren Räumen des Hauses werden die Differenzen selbstverständlich kleiner.

Auch bei besetztem Hause beträgt die Differenz noch 6 Grade Celsius, indem auf der Gallerie bei Gasbeleuchtung 29° C. (= 23,2° Réaumur) und bei elektrischer Beleuchtung 23° C. (= 18,4° Réaumur) beobachtet wurde. Bei elektrischer Beleuchtung war die Temperatur im III. Range (23° C.) nicht einmal so hoch wie bei Gasbeleuchtung schon im I. Range.

Es darf noch darauf aufmerksam gemacht werden, dass bei den Versuchen mit Gasbeleuchtung die Temperatur im Freien niedriger war, als bei den Versuchen mit elektrischer Beleuchtung, so dass also letztere jedenfalls nicht im Vortheile war.

Die Kohlensäure der Luft anlangend, kann ich nur bemerken, dass bei leerem Hause die wesentlich nur von den Gasflammen stammende Kohlensäurevermehrung sich gleichfalls in einem ähnlich steigenden Grade bemerkbar machte, wie die Temperatur. Zu Anfang des Versuchs war der Kohlensäuregehalt der Luft im Zuschauerraum . . . . . 0,4 pro mille

bei Gasbeleuchtung nach einer halben Stunde:

im	Parket	0,5	„	„
„	I. Range	1,1	„	„
„	III. „	1,4	„	„

nach einer weiteren halben Stunde:

im	Parket	0,6	„	„
„	I. Range	1,0	„	„
„	III. „	2,0	„	„

Bei elektrischer Beleuchtung:

Anfangs		0,4	„	„
nach einer Stunde im	Parket	0,5	„	„
„	I. Range	0,5	„	„
„	III. „	0,6	„	„

Da die elektrische Beleuchtung nach Edison gar keine Kohlensäure liefert, so muss diese geringe Kohlensäurevermehrung bei elektrischer Beleuchtung der Gegenwart von einigen Arbeitern auf der Bühne und von den die Beobachtungen Ausführenden zugeschrieben werden.

Bei besetztem Hause hätte man eine ebenso merkliche Differenz im Kohlensäuregehalte der Luft zwischen Gas- und elektrischer Beleuchtung erwarten mögen, wie bei leerem Hause, die sich aber nicht ergeben hat.

Bei besetztem Hause betrug das beobachtete Kohlensäure-Maximum bei Gasbeleuchtung 2,3 pro mille
„ elektrischer Beleuchtung 1,8 „ „

Die Ursachen des scheinbaren Widerspruchs sind jedenfalls mehrere. Die Kohlensäure stammte aus zwei Quellen, die nicht immer gleichmässig flossen: einmal von den Gasflammen, dann von den Menschen im Zuschauerraum und auf der Bühne. Akt und Zwischenakt bringen sowohl auf der Bühne als auch im Zuschauerraum uncontrolirbare Wechsel hervor. Ferner ändert sich der Luftwechsel im Zuschauerraum, je nachdem sich Logenthüren öfter oder seltener, mehr oder weniger weit öffnen und schliessen. Ferner bewirkt die Temperaturdifferenz zwischen Theater und freier Luft, z. B. die grössere Hitze bei Gasbeleuchtung, naturgemäss eine verstärkte Ventilation, wozu namentlich auch der Gas-Kronleuchter im Zuschauerraum beiträgt. Bei elektrischer Beleuchtung ist entsprechend der geringeren Temperaturdifferenz zwischen innen und aussen auch ein geringerer Luftwechsel bedingt, weshalb die von den Menschen erzeugte Kohlensäure nicht in dem Maasse wie bei der Gasbeleuchtung entweicht. Die bei Gasbeleuchtung verstärkte Ventilation wird auch die Ursache sein, weshalb bei besetztem Hause der Unterschied der Temperaturen zwischen Gas- und elektrischer Beleuchtung nicht so gross gefunden wurde wie bei leerem Hause.

Aus den vorliegenden Untersuchungen lassen sich mit Bestimmtheit zwei Schlüsse ziehen:

1) dass die elektrische Beleuchtung im hohen Grade die Ueberhitzung der Luft im Theater verhindert;

2) dass sie allerdings an und für sich nicht im Stande ist, die Ventilation des Theaters entbehrlich

zu machen, dass sie aber eine geringere Ventilation desselben erfordert, als die Gasbeleuchtung, bei welcher die Ventilation nicht nur gegen die Luftverderbniss durch Menschen, sondern auch gegen die Hitze und die Verbrennungsprodukte der Flamme gerichtet werden muss, während sie es bei elektrischer Beleuchtung nur mit dem Athem und der Hautausdünstung der Menschen und deren Folgen zu thun hat.

Dr. Max v. Pettenkofer,
k. geheimer Rath und Professor.

München, den 13. Juni 1883.

Tabelle zu vorstehendem Gutachten
von Prof. **M. v. Pettenkofer.**

Temperatur der Luft im Theater.

	Gasbeleuchtung						Elektrische Beleuchtung					
	I. Versuch 2. Mai 83 leeres Haus Temp.i.Freien 11,8° C.			II. Vers. 6. Mai 83 volles Haus Temp.i.Freien 11,5° C.			III. Vers. 29. Mai 83 leeres Haus. Temp.i.Freien 17,6° C.			IV. Vers. 10. Juni 83 volles Haus. Temp. i. Freien 15° C.		
	Parket	I. Rang	III. Rang	Parket	I. Rang	III. Rang	Parket	I. Rang	III. Rang	Parket	I. Rang	III. Rang
Minimum	15,2	16,2	16,2	16,0	16,8	21,6	16,6	17,2	17,6	17,6	18,0	18,8
Maximum	16,5	19,4	25,4	22,2	23,6	29,0	16,9	18,0	18,5	19,6	21,2	23,0
Differenz	1,3	3,2	9,2	6,2	6,8	7,4	0,3	0,8	0,9	2,0	3,2	4,2

Besonders ist aus dem Gutachten der Passus zu berücksichtigen, welcher betont, dass die elektrische Glühlichtbeleuchtung eine geringere Ventilation erfordert, als die Gasbeleuchtung. Was für die Theater gilt, hat auch Geltung für andere Lokalitäten, und somit ergiebt sich, dass die Glühlampe allein im Stande ist, eine Beleuchtung geschlossener Räume zu ermöglichen, welche hygienischen Anforderungen entspricht.

II.

Beleuchtung und Schädigung der Augen.

Genaue statistische Erhebungen haben zweifellos erkennen lassen, dass die Zahl der Kurzsichtigen, namentlich auf höheren Lehranstalten, im Zunehmen begriffen ist.

Auf Grund dieser Erhebungen sind die Ursachen der Zunahme der Kurzsichtigkeit aufgesucht worden und Mittel zur Abhülfe in Vorschlag gebracht.

Es ist unzweifelhaft, dass besonders die mangelhafte Beschaffenheit der gebräuchlichen Lichtquellen und deren unrationelle Benutzung den meisten Schaden bringen, und leitet desshalb auch Prof. Hermann Cohn*) (Breslau) seinen am 18. Mai d. J. auf dem hygienischen Congresse zu Berlin gehaltenen Vortrag über künstliche Beleuchtung, dem wir in dem vorliegenden Kapitel viele höchst interessante Daten entnommen haben, mit folgenden Worten ein: „Die Ansprüche,

*) Dieser Gelehrte erhielt auf der Hygiene-Ausstellung wegen seiner graphischen Darstellung über die Zunahme der Kurzsichtigkeit in den deutschen Gymnasien die goldene Medaille.

welche in Bezug auf Verbesserung der künstlichen Beleuchtung in früherer Zeit von sehr hervorragenden Männern gestellt wurden, müssen wohl sehr geringe gewesen sein. Als Beweis diene ein wenig bekannter Vers des grössten deutschen Dichters. Goethe sagt wörtlich in seinen Sprüchen in Reimen (Band III, S. 13 Cotta'sche Ausgabe 1855):

„Wüsste nicht, was sie Besseres erfinden könnten
Als wenn die Lichter ohne Putzen brennten."

Eine grössere Erfindung betreffs der künstlichen Beleuchtung wünschte also ein Goethe nicht. Die Dunkelheit der Kerze scheint ihn weniger genirt zu haben, als die Unbequemlichkeit des Putzens.

Welche Ansprüche stellen wir dagegen heute an die künstliche Beleuchtung? Eine Putzscheere findet sich, höchstens noch als Curiosität in einem Alterthumsmuseum; die Talglichter sind verbannt; die Nacht wird durch das elektrische Licht in Tag verwandelt, und immer noch bemühen sich die bedeutendsten Männer, die künstliche Beleuchtung zu vervollkommnen.

Mit diesem enormen Aufschwunge der Technik der künstlichen Beleuchtung sind aber die hygienischen Untersuchungen über den Einfluss der verschiedenen künstlichen Beleuchtungsarten auf unser Auge leider gleichen Schritt durchaus nicht gegangen."

Die Hygiene verlangt von einer dem Auge nicht schadenden, künstlichen Beleuchtung, dass sie*)

1. eine hinlängliche Lichtmenge entwickle,
2. nicht zu grell sei,

*) Wiel und Gnehm, Hdbch. der Hygiene. 1878—1880. S. 427. Schürmann-Eversbusch. „Die Hygiene der Augen." Preisschrift.

3. durch Wärmestrahlung sich nicht unangenehm bemerkbar mache,
4. ein stetiges und gleichmässiges Licht gebe und endlich
5. eine möglichst geringe Luftverschlechterung herbeiführe.

Wenn auch zugestanden werden muss, dass die beiden ersten Forderungen durch die jetzt gebräuchlichste Lichtquelle, das Gaslicht, genügend erfüllt werden, da dasselbe sehr beträchtliche Lichtmengen zu liefern im Stande ist, deren Intensität durch Milchglasteller oder Glocken gemildert werden kann, so muss jedoch hinsichtlich der drei letzten Punkte die Gasbeleuchtung als durchaus unhygienisch bezeichnet werden. Edison's Beleuchtungssystem ist es nun, welches gänzlich frei von den oben bezeichneten Mängeln der jetzt gebräuchlichen Beleuchtungsarten, dagegen mit allen den Vorzügen ausgerüstet ist, welche die Hygiene von einer guten Beleuchtung verlangt.

Die Untersuchungen der Augenärzte haben ergeben, dass mit Abnahme der Lichtintensität die Sehschärfe sinkt und zweifellos die Kurzsichtigkeit, namentlich der Schuljugend, vor allen Dingen in der schlechten und unzureichenden Beleuchtung der Schulräume ihren Grund hat. Die in dem oben citirten Vortrage mitgetheilten Untersuchungen des Prof. Hermann Cohn zeigen, dass das elektrische Licht in Folge seiner grösseren Helligkeit gegenüber dem Gaslichte die Sehschärfe um $^1/_5$—$^1/_2$ erhöht, wesshalb derselbe auch seine Ansicht dahin ausspricht, dass die Einführung des elektrischen Lichtes in den Schulen wohl nur eine Frage der Zeit sei. Sehr wichtig sei auch die Beobachtung von Carp in Marburg, der gefunden hat, dass bei Kurzsichtigen die Sehschärfe bei schlechter Beleuchtung ausserordentlich viel schneller abnimmt als bei Normalsichtigen.

Bezüglich der Frage nach dem Minimum des Lichtes, bei welchem das Auge noch arbeiten kann, stimmen die Ansichten des Prof. Cohn mit denen des französischen Gelehrten Javal überein, welcher sagt: „Il n'y a donc jamais trop, il n'y a jamais assez de lumière artificielle". So lautet dann eine weitere Aufgabe der Hygiene: „Man schaffe dem Arbeitenden möglichst viel künstliches Licht."

Besonders nachtheilig für die Gesundheit ist die dem Gaslichte entströmende Hitze, welche eine Austrocknung des Auges, Erhitzung des Kopfes, Blutandrang nach demselben mit folgendem Kopfschmerze bewirkt. Versuche von Prof. Cohn haben gezeigt, wie sehr auch in diesem Punkte das elektrische Glühlicht dem Gaslicht überlegen ist. Bringt man z. B. ein berusstes Thermometer 10 cm entfernt von einer Gasflamme von 20 Normalkerzen und ein zweites ebensolches Thermometer in derselben Entfernung vor einer zwanzigkerzigen Edison-Glühlampe an, so steigt bei einer Zimmertemperatur von 14° nach 10 Minuten das Thermometer in der Nähe des Glühlichts um 12,8°, das in der Nähe des Gaslichtes dagegen um 23,5°, also annähernd um das Doppelte! Der gleiche Versuch wurde bei einer Zimmertemperatur von 12° wiederholt, und zeigten die Thermometer entsprechend 11° und 22,6°.

Hierauf wurde mit einer empfindlichen Thermosäule gemessen, die aus dem physikalischen Institute der Universität Breslau stammte, und deren Ausschläge vorher nicht mit dem Thermometer verglichen worden waren. Die Thermosäule gab beim elektrischen Lichte in 20 cm Entfernung einen Ausschlag von 45°, dagegen bei Gaslicht von 72°. Dr. Grätz, Privatdocent der Physik in München, hat später die Thermosäule genau auf Thermometergrade übertragen, und es stellte sich heraus, dass diese Ausschläge ganz genau 3° und 6° C. entsprachen, also wieder das Verhält-

niss 1:2 war. Daraus folgt, dass das Gaslicht bei 20 cm Entfernung doppelt so stark erhitzt, wie das Glühlicht. Mit weiteren Untersuchungen in der Entfernung von $^1/_2$ m ist Prof. Cohn noch beschäftigt. Derselbe ist der Ansicht, dass bei dieser Entfernung die Differenzen noch viel mehr zu Gunsten des elektrischen Lichtes ausfallen dürften; denn in dieser Entfernung fühle man beim Glühlicht gar keine, beim Gaslichte aber noch eine ganz beträchtliche Wärme.

Die Empfindlichkeit des Auges gegen Wärme, berichtet Prof. Cohn weiter, sei übrigens bei verschiedenen Personen auch eine sehr verschiedene. Vor 15 Jahren habe er die Augen von 132 Schriftsetzern geprüft und 51% kurzsichtig gefunden. Bei dieser Gelegenheit liess er sie abstimmen über die Beleuchtung, die ihnen am wünschenswerthesten sei. Nur 72 stimmten für Gas, die anderen 60 zogen der geringeren Hitze wegen Oel und Petroleum vor.

Von 72 Uhrmachern erwiesen sich nur 9% als kurzsichtig. Die Uhrmacher müssen bei ihren feinen Arbeiten die Flamme ganz besonders nahe, — auf 25 selbst 18 cm — an das Auge bringen, und in der That stimmten 54 also $^3/_4$ der Uhrmacher für Oel oder Petroleum, da das Gas ihr Auge zu sehr austrockene.

Natürlich könne man ja die Hitzewirkung verringern, allein bekanntlich nimmt die Helligkeit im Quadrat der Entfernung ab, und man müsse also eine doppelte, und selbst eine vierfache Menge von Licht brauchen, wenn man die Hitze vermeiden und doch gleiche Helligkeit haben wolle. Das alles sei aber bei Glühlicht nicht nöthig, da es eben fast gar nicht erhitzt.

Diese und andere Versuche — wir erinnern hier an das oben angeführte Gutachten von Prof. v. Pettenkofer — sowie die

zahlreichen praktischen Anwendungen des Edison-Lichtes haben zur Genüge bewiesen, dass die Wärmeentwicklung desselben eine so geringe ist, dass durch dieselbe ein schädlicher Einfluss auf den menschlichen Körper nicht stattfindet.

Bei Erörterung der Frage, welchen Schaden die zuckende Beleuchtung dem Auge bringt, sagt unser mehrfach erwähnter Gewährsmann: „Wenn eine Flamme zuckt, so wechselt die Beleuchtungsintensität ausserordentlich schnell. Die Netzhaut ist aber für sehr kleine Lichtunterschiede schon sehr empfindlich, wie viel mehr, wenn die Unterschiede sehr grosse sind. Wenn nun die Intensität so ausserordentlich schnell wechselt, wie bei den zuckenden Flammen, so wird die Netzhaut auf das Peinlichste gereizt, und die Arbeit ist auf die Dauer unmöglich. Welche Veränderungen dabei in der Netzhaut vor sich gehen, weiss man noch nicht mit Sicherheit, vielleicht muss auch die Accommodation sich dabei fortwährend ändern, aber das Eine steht positiv fest: „Das zuckende Licht ist unerträglich".

Ein weiterer Vorzug der Glühlampen liegt nun aber gerade darin, dass sie absolut ruhig und gleichmässig brennen, während die gebräuchlichen Gasflammen fortwährend zucken und flackern. Die Ruhe des Glühlichtes in Gemeinschaft mit seiner etwas weisseren Farbe haben eine ausserordentlich glänzende Lichtwirkung zur Folge; ausserdem thut das Licht den Augen wohl, verleiht den Farben einen besonders warmen Ton und verändert dieselben weit weniger als das Gaslicht. Die sehr eingehenden Versuche von Prof. O. E. Meyer in Breslau (s. Centralblatt für Elektrotechnik) über die Farbe des elektrischen Lichtes geben hierfür den Beweis. Derselbe hat bestimmt, in welchem Verhältnisse die Helligkeit des elektrischen Bogen- und Glühlichtes und des Gaslichtes zu derjenigen der Sonne steht, wenn die letztere so weit ab-

geschwächt ist, dass die Helligkeit des gelben Lichtes in allen vier Lichtquellen dieselbe ist.

	Gaslicht	Elektr. Glühlicht	Elektr. Bogenlicht
Roth	4,07	1,48	2,09
Gelb	1,00	1,00	1,00
Grün	0,43	0,62	0,99
Blaugrün	—	0,29	—
Blau	0,23	0,21	0,87
Violett	0,15	0,17	1,03
Aeusserstes Violett	—	—	1,21

„Man erkennt aus diesen drei Zahlenreihen sofort", bemerkt Prof. O. E. Meyer zu vorstehender Tabelle, „dass alle drei Lichter im Vergleich mit der Sonne röthlichgelb erscheinen müssen, da sie einerseits reich an rothen, andrerseits zu arm an blauen Strahlen sind, um ihren Gehalt an gelbem Licht zu Weiss zu ergänzen. Von den drei Lichtern ist das Gaslicht am stärksten roth gefärbt, das Bogenlicht ist, wie bereits früher bemerkt wurde, im Vergleich mit der Sonne gelb mit einem Stich ins Röthliche; das Glühlicht steht zwischen beiden in der Mitte. Hierauf beruht der angenehme Eindruck, den das Glühlampenlicht auf unser Auge macht. Das Licht der Glühlampe besitzt nicht das in dem Gaslichte vorhandene Uebermaass an Roth, also an derjenigen Farbe, welcher so häufig die Bezeichnung „brennend", „schreiend" u. dergl. beigelegt wird; und andrerseits gibt es nicht die geisterhafte Beleuchtung, welche das Bogenlicht durch seinen Gehalt an violettem Lichte bewirkt."

Prof. Cohn resumirt den Inhalt des erwähnten Vortrages zuletzt dahin, dass es eine Hauptaufgabe der Hygiene sei, die Eigenschaften des Tageslichtes auch beim künstlichen Lichte möglichst nachzuahmen, da das zerstreute Tageslicht dem Auge niemals schädlich ist. Daher dürfe die künstliche Beleuchtung 1) nicht blenden, 2) nicht spärlich sein, 3) nicht die Augen erhitzen und 4) nicht zucken. Man sei daher den Elektrikern zu grösstem Danke verpflichtet, da sie gezeigt haben, wie schlecht die bisherigen Beleuchtungsarten waren, so dass ein edler Wetteifer in der Verbesserung der anderen Lichtquellen nothwendig folgen musste. Der Lichthunger, welcher im Publikum durch die elektrische Beleuchtung erregt worden ist, lasse sich nicht mehr zurückdämmen und das sei gut. Denn durch bessere Beleuchtung werde der Verbreitung der Kurzsichtigkeit vorgebeugt und vielen Augen, deren Sehschärfe nicht mehr vollkommen sei, Nutzen gebracht. Das Hauptergebniss seiner Untersuchungen sei das, dass die Augen am meisten geschädigt werden durch zu geringe Beleuchtung. Der Hygieniker müsse mit Goethe's letzten Worten schliessen „Mehr Licht."

Hieran schliessen sich die für die Gesundheitspflege im höchsten Grade wichtigen Entdeckungen des Berliner Universitätsprofessors Dr. Arthur Christiani, dessen neuste Untersuchungen schlagend dargethan haben, dass das Licht auch einen hervorragenden Einfluss auf die vegetative Sphäre der menschlichen und thierischen Leibesökonomie ausübt und zwar in günstiger Weise. Dieser Forscher hat durch eingehende Beobachtungen und Experimente an Thieren die äusserst interessante und bedeutsame Thatsache festgestellt, dass abgesehen von den sonstigen Sinneswirkungen, die Erregung der Sehnerven, auch einen ganz bestimmten Theil des Mittelgehirnes, namentlich das von demselben dort entdeckte Athmungscentrum belebt und in gesteigerte Thätigkeit versetzt.

Diesen belebenden, den Athmungsprocess fördernden Einfluss kann die künstliche Beleuchtung jedoch nur dann ungehindert

ausüben, wenn sie frei von allen üblen Nebenwirkungen ist, wenn nicht die Erhitzung und Verderbniss der Luft den physiologischen Nutzen des Lichtes aufheben und zu Schanden machen. Da die elektrische Beleuchtung nach dem Edison-System alle jene Schädlichkeiten ausschliesst, so verdient sie den Vorzug vor sämmtlichen Beleuchtungsarten, und es dürfte das Wohlbehagen, welches den Aufenthalt in Räumen begleitet, die mit elektrischen Glühlampen erleuchtet sind, eine Erklärung durch die Entdeckungen Christiani's finden.

Von verschiedenen Gesichtspunkten ausgehend, kommen Prof. v. Pettenkofer und Prof. Cohn zu ein und demselben Resultate, dass nämlich die Beleuchtung durch elektrische Glühlampen, sowohl in Bezug auf die allgemeine Hygiene, als auch auf die Hygiene des Auges, Vortheile bietet, welche allen anderen Beleuchtungsarten mangeln, während die neusten Arbeiten von Prof. Christiani auf eine Bedeutung des elektrischen Glühlichtes für die Gesundheitspflege hinweisen, welche, bisher unbekannt, umsomehr gewürdigt werden wird, je umfassender die hierauf bezüglichen Untersuchungen und Erfahrungen sich gestalten.

Schon allein diese Uebereinstimmung dreier Autoritäten stellt der Edison-Beleuchtung ein Zeugniss ihrer Vorzüge aus, wie es beweiskräftiger nicht sein kann.

III.

Die Feuersicherheit des Edison-Glühlichts.

Die zunehmende Zahl grosser Brände hat Veranlassung gegeben, dass in den letzten Jahren bedeutende Anstrengungen gemacht worden sind, Vorrichtungen zu construiren und einzuführen, durch welche eine entstandene Feuersgefahr schnell beseitigt wird. Während hierin thatsächlich ausserordentliche Fortschritte gemacht worden sind, wie die diesjährige Ausstellung auf dem Gebiete der Hygiene und des Rettungswesens wohl beweist, hat man unseres Erachtens sich bisher viel zu wenig damit beschäftigt, Mittel aufzufinden, um das Entstehen eines Brandes, — welcher schnell von den kleinsten Anfängen die gefährlichsten Dimensionen annehmen kann, — möglichst zu verhindern. Unzweifelhaft ist es, dass eine grosse Zahl aller Brände durch die Beleuchtung verursacht worden ist. Fölsch giebt in seinem sehr interessanten Buche über Theaterbrände auf Grund statistischer Erhebungen an, dass die während der Vorstellung begonnenen Brände, beinahe ausnahmslos durch offenes oder schlecht geschütztes Licht entstanden sind. Es möge hier daran erinnert werden, dass das

grosse Brandunglück 1876 im Brooklyner Theater, bei dem 283 Menschen unter den Trümmern des Gebäudes begraben wurden, durch Entzündung einer Decoration an der Coulissenlampe veranlasst wurde. Noch in unser Aller Gedächtniss ist der schreckliche Ringtheater-Brand in Wien, welcher 450 Personen das Leben kostete; derselbe entstand durch Unvorsichtigkeit beim Anzünden der Soffittenflammen. Aber nicht nur die offenen Gasflammen geben zu Bränden Veranlassung, vielmehr ist auch eine ganze Reihe derselben durch Gasexplosionen verursacht worden. Die auf der Bühne befindlichen, meist offen liegenden Gasröhren sind verhältnissmässig leicht einer Beschädigung ausgesetzt; sehr häufig entsteht Feuersgefahr durch ein Undichtwerden oder Zerreissen der Schläuche, mittelst deren den Versetzstücken das Gas zugeführt wird. Eine derartige Gasexplosion gleich nach Beginn der Vorstellung hatte den Brand des Theaters in Nizza (1881) zur Folge, bei dem 150—200 Personen das Leben einbüssten.

Angesichts dieser Thatsachen sollte man nicht mehr zögern, in allen den Fällen, wo die Beleuchtung eine Feuersgefahr herbeiführen könnte, die gefahrlose, gänzlich feuersichere Glühlichtbeleuchtung von Edison einzuführen. Die Edison-Glühlampe besteht aus einer hermetisch verschlossenen luftleeren Glasglocke, welche im Innern einen mit den Stromzuleitungsdrähten verbundenen Bügel aus verkohlter Bambusfaser enthält; dieser Kohlenbügel erglüht und strahlt Licht aus, sobald ein elektrischer Strom ihn durchfliesst. Infolge dieser Construction der Glühlampen ist es nicht möglich, dass sich ein in ihre Nähe gebrachter, leicht brennbarer Körper entzünden kann. Zerbricht die Glasglocke durch Zufall, so erlischt die Lampe infolge Verbrennens des Kohlenbügels so plötzlich, dass ein Entzünden in unmittelbarer Nähe befindlicher, leicht brennbarer Körper, wie Versuche gezeigt haben, nicht eintritt.

Auch durch die Leitungen kann Feuer nicht entstehen, sobald die Anlage sorgfältig und von einem mit dem Glühlichtsystem gehörig vertrauten Unternehmer ausgeführt worden ist. Um ein Glühendwerden der Leitungen in Folge zu starken Stromes zu verhindern, sind in gewissen, durch die Erfahrung genau bestimmten Abständen Bleidrähte in dieselben eingeschaltet. Lange bevor nun an irgend einer Stelle eine Erhitzung der Leitungen in Folge Durchganges zu grosser Elektricitätsmengen eintritt, schmilzt der dieser Stelle zunächst befindliche Bleidraht, wodurch der Strom selbstthätig unterbrochen wird. Durch Versuche kann man sich leicht von der zuverlässigen Wirkung dieser Bleieinschaltungen überzeugen. Wenn Dr. Schilling in seinem Journale für Gasbeleuchtung Brände anführt, welche durch elektrische Beleuchtung herbeigeführt sein sollen, so handelt es sich dort entweder um Anlagen, welche vor dem Bekanntwerden der Sicherheitsbleieinschaltungen gemacht worden sind, oder um solche, die von Unternehmern ausgeführt wurden, welche, in mangelhafter Nachahmung des Systems Edison's, die von letzterem erfundenen Bleieinschaltungen nicht benutzten. Das von Dr. Schilling weiter gehegte Bedenken, dass bei ausbrechendem Feuer diese Beleuchtung sogleich gänzlich versage, dürfte hinfällig sein, da die mit imprägnirter Baumwolle umsponnenen Leitungsdrähte nicht mehr gefährdet sind, als die Rohrleitungen der Gasbeleuchtung, sondern im Gegentheil eine ziemlich bedeutende Erhitzung vertragen, so dass die Zerstörung der einzelnen Glühlampen nur in dem Masse allmählich erfolgen könnte, wie das Feuer um sich greift, während bei der Gasbeleuchtung sofort der Haupthahn geschlossen werden muss.

Nebenbei möge auch erwähnt werden, dass eine Gefahr für das Leben der Menschen bei Anwendung der Glühlichtbeleuch-

tung gänzlich ausgeschlossen ist, da elektrische Ströme von solcher geringen Spannung in Anwendung kommen, dass man selbst Leitungen, welche hunderte von Pferdekräften übertragen, berühren kann, ohne einen merklichen Schlag zu erhalten.

Ueber die Frage der Feuersicherheit der elektrischen Beleuchtung hat sich Dr. Werner Siemens im „Centralblatt für Textil-Industrie" ausführlich geäussert. Bei der Wichtigkeit dieses Gutachtens theilen wir die interessantesten Punkte desselben mit. Es heisst in demselben u. A.: . . . „Die Gasbeleuchtung bleibt auch bei sorgfältigster Anlage stets in hohem Grade feuergefährlich — ganz abgesehen von der directen Lebensgefahr, — denn jeder offengelassene oder undicht gewordene Gashahn kann eine lebens- und feuergefährliche Explosion hervorbringen. Dasselbe gilt von undicht gewordenen Rohrleitungen. Dagegen ist eine solide und sachgemäss angelegte elektrische Beleuchtung fast gänzlich ungefährlich. . . . In Räumen, in welchen viele brennbare Fäden oder sonstige Stoffe umherfliegen, oder in welche brennbare Dämpfe eindringen können, wird ein Sachverständiger keine offenen Flammen — seien es Gas-, Petroleum- oder elektrische Flammen anbringen. Für solche Räume eignen sich besser die Glühlichter. Bei diesen ist die Feuersgefahr bei richtiger Anlage wirklich beinahe verschwindend klein, da der leuchtende Körper hermetisch in einer Glaskugel eingeschlossen ist. In Räumen, in welchen brennbare Stoffe mit den Wänden der Glaskugel in Berührung kommen können, kann man ausserdem Doppelglocken anwenden, um eine Entzündung an den heissen Wänden der Glaskugeln zu verhindern. Bei einer nicht mit Sachkenntniss und grösster Solidität ausgeführten Glühlichtanlage kann allerdings eine Gefahr dadurch eintreten, dass die Leitungen nicht richtig berechnet sind und sich erhitzen, oder dass sie nicht

sicher eingebettet und befestigt oder schlecht isolirt sind. Endlich auch dadurch, dass nicht genügende Sicherheitsvorrichtungen angebracht sind, die verhindern, dass der elektrische Strom stärker werden kann, wie es die Drähte vertragen. In allen diesen Fällen kann es vorkommen, dass Drähte sich in gefährlicher Weise erhitzen oder durch zufällige Berührung zweier Drähte an der Berührungsstelle elektrische Flammen sich bilden, welche zünden können. Das Alles darf bei einer gut und mit Sachverständniss gemachten Anlage aber gar nicht vorkommen, so wenig wie es vorkommen darf, dass Gasleitungen undicht oder dem Zerbrechen etc. ausgesetzt sind. So richtig es demnach ist, dass schlecht angelegte elektrische Beleuchtungseinrichtungen feuergefährlich sein können, so unrichtig ist es, das System der elektrischen Beleuchtung überhaupt für feuergefährlich oder gar für feuergefährlicher als die Gasbeleuchtung zu erklären! . . ."

Das Publikum wird hiernach also die Ausführung von Beleuchtungsanlagen, gerade wie die anderer technischer Anlagen, nur solchen Unternehmern anvertrauen dürfen, deren Kenntnisse und Erfahrungen eine volle Gewähr für gute und solide Ausführung bieten. Leider lässt sich nicht verkennen, dass bei der schnellen Entwickelung des elektrischen Beleuchtungswesens sich diesem neuen Industriezweige Manche zuwandten, denen die erforderliche Sachkenntniss fehlte. Die leicht erklärlichen Misserfolge derartiger Unternehmer tragen dann leicht dazu bei, eine an sich gute und lebensfähige Sache in den Augen des Publikums herunterzusetzen.

Die Frage der Brauchbarkeit und Zweckmässigkeit des elektrischen Glühlichtes wird bisher vielfach im Zusammenhange mit der Frage der Theaterbeleuchtung verhandelt. Und dies ist auch sehr natürlich; denn die entsetzlichen Unglücksfälle der letzten Jahre haben die Techniker gezwungen, nicht nur

Vorsichtsmassregeln gegen die bestehenden Beleuchtungsarten zu ergreifen, sondern auch daran zu denken, die bisherigen, sehr gefahrvollen Beleuchtungsmittel durch neue und zweckentsprechendere zu ersetzen. Einen sehr werthvollen Beitrag liefert ein Gutachten der Kgl. Akademie des Bauwesens, welches aus Veranlassung der Katastrophe im Theater von Nizza im Auftrage des Ministers der öffentlichen Arbeiten abgegeben wurde. Auf den ersten Theil des Gutachtens, welcher sich ausschliesslich auf die Anordnungen und Einrichtungen bezieht, welche in bautechnischer bezw. baupolizeilicher Hinsicht zur Verminderung der Feuersgefahr in Theatern dienen, wollen wir hier nicht näher eingehen, dagegen einen Auszug aus dem zweiten Theile bringen, welcher speciell auf die Beleuchtung Bezug hat. Es heisst daselbst:

„1) Die Feuergefährlichkeit der Theater beruht vorzugsweise auf der Verwendung leicht entzündlicher und nach der Entzündung rasch aufflammender und das Feuer schnell weiter verbreitender Stoffe zur Ausstattung des Bühnenraums, bei Anwendung

2) einer Beleuchtung, welche starke Wärme verbreitet, brennbare Gegenstände entzündet und heisse Verbrennungsgase entwickelt, die an den leicht entzündlichen Stoffen vorüberstreifend, nach dem Schnürboden aufsteigen.

3) Vollständige Sicherheit kann deshalb nur durch die Beseitigung der verbrennbaren Gegenstände oder durch die Beseitigung der Erleuchtung mit „offenem Licht" und deren Ersatz durch die Beleuchtung mit verschlossenem und zwar möglichst „luftdicht verschlossenem Licht" erzielt werden.

4) Die Grösse der Feuersgefahr nimmt naturgemäss mit der Menge der leicht entzündlichen Gegenstände und mit der Anzahl der Gasflammen bezw. offenen Lichte zu und ab. Sie wächst somit im Allgemeinen mit der Grösse der Bühne.

Ebenso wächst bei ausgebrochenem Feuer die Gefährdung der Zuschauer mit der Anzahl der letzteren, im Allgemeinen also mit der Grösse des gefüllten Zuschauerraumes.

Es wird deshalb zur Verhütung von Unfällen die feuersichere Anlage und Ausstattung der Theater um so dringender, je grösser die letzteren sind."

In dem Gutachten wird zunächst der Ersatz aller Constructionstheile aus Holz durch solche aus Eisen und wo dieses nicht zulässig ist, die Imprägnirung aller Hölzer und Gewebe gefordert, vor allen Dingen aber die Beseitigung des offenen Lichts empfohlen, da letzteres nach den statistischen Angaben von Fölsch (s. oben) bei den während der Vorstellung begonnenen Bränden beinahe ausnahmslos die Veranlassung gewesen ist. Nach derselben Quelle gehören auch alle Theater, welche kurz vor Einlass des Publicums durch unvorsichtiges Entzünden der Gas- oder Oelflammen in Brand geriethen, zu der reich vertretenen Kategorie derjenigen Bühnenanlagen, welche durch schlecht behütetes offenes Licht zu Grunde gingen.

Es heisst dann in dem Gutachten weiter:

„Es kann dies nicht überraschen, da auf der Bühne die grosse Menge leicht entzündlicher Gegenstände mit einer grossen Anzahl offener Flammen durchsetzt ist, um dem Bedürfniss einer hellen Beleuchtung Genüge zu thun. Diese Flammen müssen wenigstens zum Theil abwechselnd entzündet und gelöscht und den beabsichtigten künstlerischen Effecten entsprechend an verschiedene Stellen der Bühne gebracht werden. Jede falsche oder verunglückte Bewegung einer Coulisse oder eines anderen feuerfangenden Gegenstandes, jeder Bruch eines Bewegungsmechanismus kann eine Berührung entzündlicher Gegenstände mit offenen Flammen, mithin die Gefahr einer Entzündung herbeiführen. Noch wesentlich er-

höht wird diese Entzündungsgefahr durch die Anwendung des Leuchtgases. Erfolgt dabei auch das Anzünden der Flammen auf die verhältnissmässig sicherste und gefahrloseste Weise, auf elektrischem Wege, so kann die Zündung doch versagen. Dann strömt das Gas unverbrannt aus, und der nächste Zündungsversuch bewirkt eine Explosion, die auch entferntere Gegenstände direct in Brand stecken oder sie anderen offenen Lichten zuschleudern kann. Fast noch grösser ist die Gefahr, wenn die Entzündung nur an einzelnen Stellen versagt, ohne dass dieses Versagen sofort wahrgenommen wird. Dann bildet sich über einzelnen Ausströmungsöffnungen ein Gasgemisch, welches sich explodirend entzündet, sobald es die offenen Flammen erreicht, wodurch die Feuersgefahr direct auf weit entfernte Punkte übertragen werden kann. In gleicher Weise können Beschädigungen der weit verzweigten Gasleitungen gefährlich wirken.

Diese Vorgänge geben Fölsch Anlass zu dem Ausspruche, dass „das allgemein und in allen civilisirten Ländern gültige Verbot von offenen Flammen an feuergefährlichen Orten — auffallend genug — für Theater ganz ignorirt wird, obwohl, soweit bekannt, in keinem Staate diese Ausnahmestellung der Theater durch ein Gesetz oder durch eine Verordnung gestattet ist."

Die Beseitigung des offenen Lichtes aus den Theatern, so lange in letzteren leicht entzündliche und aufflammende Gegenstände in grösseren Mengen benutzt werden, muss deshalb als ein unbedingtes Erforderniss der Feuersicherheit bezeichnet werden. Das Hülfsmittel hierzu bietet das elektrische Glühlicht".

Nach einer kurzen Besprechung der Construction der Glühlampen und ihrer speciellen Vorzüge für Theaterbeleuchtungszwecke heisst es in dem Gutachten weiter: „Unter Berücksichtigung aller schon bewährten günstigen Eigenschaften dieser Beleuchtungsmethode muss man sich jedoch unbedingt dahin entscheiden, dass dieselbe als geeignet und berufen erscheint, die Feuersgefahr der Schaubühne auf ein Minimum zu reduciren, ohne jede Beeinträchtigung des Zweckes der letzteren.

Obschon die Beleuchtung des Zuschauerraumes der Theater weit weniger Gefahren mit sich führt, wie die der Bühne, erscheint es doch rathsam, auch für diesen und überhaupt für das ganze Haus zur elektrischen Beleuchtung überzugehen. Ausser der grösseren Sicherheit gegen Feuerschaden bietet die elektrische Beleuchtung des Zuschauerraumes noch den grossen Vortheil, dass die Wärmeentwickelung verhältnissmässig bei ihr sehr gering ist, und dass vor allen Dingen die Luft durch die Beleuchtung nicht verdorben wird. Das Ventilationsproblem lässt sich bei allgemeiner elektrischer Beleuchtung daher leichter lösen als bei Gasbeleuchtung."

Zu unsrer grossen Genugthuung sehen wir, dass nun auch die Feuerversicherungs-Gesellschaften anfangen, sich von der grossen Feuersicherheit der elektrischen Glühlichtbeleuchtung zu überzeugen und daher hoffentlich bald allgemein die Prämien bei Anlagen mit Glühlichtbeleuchtung herabsetzen werden. Die Magdeburger Feuerversicherungs-Gesellschaft äussert sich in einem ihrer Haupt-Agentur-Circulare über den jetzigen Stand der Beleuchtungsfrage u. A. folgendermassen:

„Von allen objectiven Gefahrsmomenten, denen das Feuerversicherungsgeschäft, besonders bei Deckung industrieller Anlagen, unterworfen ist, nimmt zweifellos die Beleuchtungsgefahr den hervorragendsten Platz ein; ihr begegnen wir überall in mehr oder weniger drohender Gestalt, je nach dem Character der versicherten Risiken. Es ist deshalb in erster

Linie von jeher unsere Aufgabe gewesen, diese überall vorhandene Gefahr mit aller Aufmerksamkeit zu verfolgen und ihr, so viel als möglich von ihrem Beginn an, entgegenzutreten, also von der Aufbewahrung der zur Füllung der Lampen erforderlichen Materialien, von dem Putzen und Füllen der Lampen mit Rüböl oder Petroleum, von der Herstellung des Gases, sofern diese auf dem betreffenden Risico selbst stattfindet, und von der Gasleitung bis zu den verschiedensten Arten der Gaslampen.

Ganz besonders hatten wir aber auf die Beleuchtung der feuergefährlichen Betriebe und unter diesen wiederum derjenigen zu achten, bei denen es sich um Ausströmung leicht entzündlicher explosibler Gase oder Mischungen fester Körper in feinem Zustande mit der Luft handelte, und gerade bei diesen Betrieben ist bisher unser Bestreben, die Gefahr genügend einzudämmen, nur in sehr unvollkommenem Masse mit Erfolg gekrönt worden, denn wir dürfen uns nicht verhehlen, dass das Auskunftsmittel der Aussenbeleuchtung und der Verwendung von Sicherheitslampen nach Davy'schem Systeme im Innern der betreffenden Räume doch nur in solchen Fällen ausgiebigen zuverlässigen Schutz gewährt, in denen die vorgeschriebene Beleuchtung für den Betrieb ausreicht. Wo dies nicht der Fall ist, wo vielmehr ein grösseres Lichtbedürfniss, wenn auch nur zeitweilig, befriedigt werden muss, begegnen wir immer und immer wieder der verbotenen Beleuchtung mit genügend leuchtenden, aber ungenügend geschützten Lampen, Laternen oder Kerzen. Vor allen Gefahrsmomenten der Beleuchtung tritt aber in den Vordergrund die Anzündegefahr der Lampen etc., sie mögen beschaffen sein, wie sie wollen. Wir dürfen nicht die Augen vor der Thatsache verschliessen, dass alle unsere Verbote des Gebrauches von Streichhölzern oder offenen Lampen zum Anzünden der Beleuchtungsflammen, alle unsere Gebote und Empfehlungen, diese oder jene Methode dafür innezuhalten, nicht immer und überall durchgeführt werden, selbst da nicht, wo wir seitens der Versicherten uns des besten Willens versehen dürfen, dieser Gefahr auf das Ernsteste entgegenzutreten.

Vor Allem springt bei der elektrischen Beleuchtung der Wegfall der so verderblichen Anzündegefahr der einzelnen Flammen hervor, und dieser Punkt allein schon muss vom Standpunkte der Feuerversicherung als im hohen Grade massgebend für ihre Stellung zur Frage der elektrischen Beleuchtung erachtet werden. Ferner bietet die elektrische Beleuchtung in ihrer Leitung, sofern sie genügend isolirt ist, jedenfalls grössere Sicherheit, als jede andere Beleuchtungsart, bei welcher entweder flüssiger oder gasförmiger Brennstoff in mehr oder weniger gefährlichem Grade vorhanden und bereit ist, einen Brand hervorzurufen, oder doch zu verstärken. Auch ist die elektrische Lampe jedenfalls nicht gefährlicher, als andere Lampen, die schon durch ihre grosse Hitzeausstrahlung recht bedenklich sind, und bei Einrichtung von elektrischer Glühlichtbeleuchtung endlich darf von der Lampe selbst behauptet werden, dass sie Feuersicherheit in so vollkommenem Grade gewährt, selbst in den feuergefährlichsten Räumen, dass sich mit ihr keine andere Beleuchtungsart auch nur entfernt messen kann."

Es gewährt uns eine grosse Befriedigung, mittheilen zu können, dass bereits eine achtbare Zahl von Theaterdirektionen sich diesen und ähnlichen Ausführungen berufener Fachleute nicht verschlossen hat, sondern die Beleuchtung der betreffenden Theater mit Glühlicht ins Werk setzte. Desgleichen sind

bereits viele Fabriken, Spinnereien, Webereien, Brauereien u. s. w. mit Glühlicht nach dem System Edison versehen. Trotzdem bleibt noch viel zu thun übrig, bevor die Arbeiten Edison's auf dem Gebiete des elektrischen Beleuchtungswesens zum segensreichen Gemeingut werden, aber es ist zu erwarten, dass je mehr die Lehren und Anforderungen der Hygiene — der Pflege des Menschen in gesunden Tagen — verstanden und populär werden, und die Feuersgefahr der üblichen Beleuchtungsmittel erkannt wird, auch jene künstliche Beleuchtung die ihr zukommende Verbreitung findet, die allen hygienischen Ansprüchen Rechnung tragende und gänzlich feuersichere Glühlichtbeleuchtung nach dem System Edison.

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EDISON GESELLSCHAFT

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(Volleingezahltes Capital: 5,000,000 Mark)

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DEUTSCHEN EDISON GESELLSCHAFT
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Beleuchtung von Theatern
mit
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BERLIN.
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1884.

INHALT.

Die Reform der Theaterbeleuchtung.

Als das Leuchtgas die ehrwürdigen Oel-Lampen aus den Theatern verdrängte, glaubte man mit dem neuen Lichte eine ausserordentliche Verbesserung eingeführt zu haben. In der That bot das Gas eine Reihe von wesentlichen Vortheilen in seiner bequemen Handhabung und in der leichter zu erzielenden grösseren Lichtmenge. Das mühsame Instandhalten der Lampen kam in Wegfall, man konnte sowohl den Zuschauerraum wie die Bühne müheloser verdunkeln und erhellen, das Anzünden der Flammen erfolgte rascher, die Reinlichkeit war eine grössere, der Zuschauerraum erschien glänzender und prunkhafter und die scenischen Vorgänge erhielten eine intensivere Beleuchtung, als die milde Flamme der Oel-Lampen ihnen zu geben vermochte

Dass nun aber gleichzeitig mit diesen Vortheilen eine Anzahl von Nachtheilen eingeführt wurde, übersah man in der Freude über die neue Errungenschaft, und da eine Rückkehr zu der alten Beleuchtung nicht möglich war, fügten sich das Publikum, sowie die Schauspieler, den Uebelständen, die das Gaslicht im Gefolge hatte, und ertrugen die Unannehmlichkeiten mit Resignation, welche aus dem Gedanken hervorging, dass eine Abstellung der Uebel nun einmal zu den frommen Wünschen gehöre.

Zu diesen Uebelständen zählt in erster Linie die Ueberhitzung der Theater durch die Gasflammen. Nur einige der wenigen neu angelegten Theater sind mit Ventilationsvorrichtungen versehen, die eine Herabminderung der Temperatur durch Zufuhr abgekühlter Luft ermöglichen, die übrigen, nach

altem Stile eingerichteten, sind geblieben, was sie waren: Räume, in denen die Temperatur von Stunde zu Stunde bis zur Unerträglichkeit steigt. Gegen das Ende einer Oper, eines Schaupieles gleichen die Theater, namentlich bei milder Witterung, fast den geheizten Räumen eines römischen Bades, und in der warmen Jahreszeit, wenn die Reisen beginnen, die Städte von Fremden besucht werden, welche ungern auf den Besuch des Theaters verzichten, gebietet die Nothwendigkeit den Schluss der Kunstinstitute, welche naturgemäss eine grosse Anziehungskraft auf das reisende Publikum ausüben und zur Fremden-Frequenz wesentlich beitragen müssten.

Geistiges und körperliches Unbehagen beeinträchtigen nicht nur den Genuss, sondern sind im Stande ihn aufzuheben, sobald sie überhand nehmen. Es ist ferner eine durch vielfache Erfahrung bestätigte Thatsache, dass hohe Temperaturen erschlaffend auf den Körper und den Geist wirken. In den südlichen Gegenden zwingt die Hitze der Mittagszeit den Menschen zum Einhalten der Arbeit und macht die Siesta, welche dem Nordländer nicht als Bedürfniss erscheint, zur unumgänglichen Nothwendigkeit, ebenso wie der Europäer in den Tropen von der Spannkraft einbüsst, welche ihm in den gemässigten Breiten eigen ist.

In den Theatern, deren Temperatur die Gasbeleuchtung über die normale, dem Organismus geeignete, erhöht, in den Konzertsälen, welche an demselben Uebelstande leiden, wird von dem Zuschauer und Hörer Aufmerksamkeit, vermehrte Receptionsfähigkeit und eine Empfänglichkeit für das Gebotene verlangt, die eine gesteigerte Thätigkeit der Sinne und des Geistes erfordert, eine Arbeit, ohne welche der Genuss eines Kunstwerkes nicht denkbar ist. Unter dem ermattenden Einflusse der Hitze, der durch die Verbrennungsprodukte des Gaslichtes verunreinigten Luft erschlaffen Körper und Geist um so

mehr, je länger der Aufenthalt in der Hitze und der verdorbenen Luft dauert, je mehr die Verderbniss und die Steigerung der Temperatur zunehmen.

Die bedeutende Steigerung der Temperatur und die Zunahme der Luftverderbniss in menschenerfüllten gaserleuchteten geschlossenen Räumen, zumal in Theatern, ist von Prof. M. von Pettenkofer zahlenmässig nachgewiesen;*) sie macht sich jedoch auch ohne thermometrische Beobachtung deutlich in der Abspannung bemerkbar, die dem Zuschauer den Genuss verkümmert, da er dieselbe überwinden muss, um empfänglich — genussfähig zu bleiben und nicht zu ermüden. Die Häufung der Effecte gegen das Ende eines Theaterstückes, die Anwendung scenischer Reizmittel in den letzten Akten, welche der Neuzeit, den früheren Epochen gegenüber, zum Vorwurfe gemacht werden, haben nicht zum geringen Theil ihren Grund darin, dass es gilt, ein durch hohe Temperatur erschlafftes und ermüdetes Publikum durch kräftigere Mittel anzuregen, als genau genommen mit edler Kunst vereinbar sind.

Mit dem Gaslichte sind die Bedingungen, unter denen die dramatischen Schöpfungen zur Darstellung gelangen, andere, als zu den Zeiten geworden, von denen viel des Rühmlichen berichtet wird. Ob zu ihrem Vortheile, wollen wir hier nicht entscheiden, sondern überlassen den Kunstästhetikern die eingehende Untersuchung dieser Frage.

Dem Publikum gegenüber steht der darstellende Künstler, der mit dem Aufgebote physischer und geistiger Kraft die Werke der Dichter und Komponisten zu verkörpern sucht. Auch auf ihn wirkt die Steigerung der Temperatur, und zwar um so eindringlicher, als der Schauspieler oder Sänger, direkt von den

*) Vergl. Veröffentlichung der Deutschen Edison Gesellschaft I. „Das Edison-Glühlicht und seine Bedeutung für Hygiene und Rettungswesen. S. 11.

Wärmestrahlen der Gaslampen getroffen wird, welche zu allen Seiten, hinter den Koulissen, oben hinter den Soffitten und zu seinen Füssen an der Rampe angebracht sind. In der von diesen Lampen unaufhörlich neu erzeugten Hitze ist der Künstler gezwungen zu spielen, zu sprechen, die Kraft auszugeben, welche die Rolle erfordert. Wer da weiss, welche physische Kraft die Darstellung einer grossen Rolle erfordert, kann ermessen, was es heisst, dieselbe in einer Temperatur zu Ende zu führen, welche den Südländer zur Siesta zwingen würde.

Dazu kommt, dass die den Gaslampen der Rampe entströmenden warmen Verbrennungsgase von dem Darsteller eingeathmet werden, dass die trockene erwärmte Luft das Sprechen und Singen erschwert, da sie ausdörrend auf die Schleimhäute des Mundes und der Kehle einwirkt. Es ist daher nicht zu verwundern, wenn dem in Schweiss gebadeten Künstler bisweilen die Kräfte erlahmen, das Organ nicht in erwünschter Fülle anspricht und der Darsteller in einer schwierigen, an und für sich schon grosse Anstrengung erfordernden Rolle zum Schluss derselben, wie der landläufige Ausdruck lautet, „nicht auf gleicher Höhe bleibt".

Man ziehe die Umstände in Betracht, welche dem Künstler die Ausübung seiner Kunst erschweren, und man wird begreiflich finden, dass es ein kaum zu erfüllendes Verlangen ist, dem Darsteller zuzumuthen, in einer Temperatur körperlich und geistig nicht zu ermatten, die durchweg höher ist, als diejenige, welche schon den ruhig dasitzenden Zuschauer in seiner Empfänglichkeit beeinträchtigt und in das Gefühl des Unbehagens, der Missstimmung und zuletzt in körperliche und geistige Erschlaffung und Ermattung versetzt.

Durch geeignete Ventilationsvorrichtungen hat man, wie bereits erwähnt wurde, die üble Einwirkung der Gasbeleuchtung in einigen Theatern unschädlich zu machen gesucht und auch befriedigende Resultate erhalten, denen jedoch bedeutende Anlage- und Betriebskosten gegenüber gestellt werden müssen, die einer allgemeinen Verbreitung der mittelst Maschinen bewerkstelligten Ventilation, welche nach der bisherigen Erfahrung die einzige zweckerfüllende ist, hindernd entgegenstehen.

Wird auch der Zuschauerraum durch Ventilationsapparate von der heissen, mit Verbrennungsprodukten verunreinigten Luft befreit, so bleibt doch die von den Rampen-Flammen aufsteigende erwärmte Luft, welche nicht nur dem Schauspieler belästigend entgegenströmt, sondern auch in akustischer Beziehung Nachtheile mit sich bringt.

Nach den Untersuchungen von W. W. Jaques*) bildet eine aufsteigende, erwärmte Luftströmung eine Wand, welche den Schall zum Theil durchlässt, zum Theil aber reflektirt, so dass der durchgehende Schall um so viel von seiner Intensität einbüsst, als von der Luftwand zurückgeworfen wird. Es gelang Jaques sogar in seinem Vorlesungssaale, durch mehrere Schichten aufwärtsströmender erwärmter Luft, so viele „Luftwände" herzustellen, dass die Reflexion derselben im Stande war, den Ton der menschlichen Stimme bis fast zur Unhörbarkeit abzudämpfen. Bei selbst langsamem Sprechen ward die Stimme nicht nur schwächer, sondern auch verworren und undeutlich, als wenn jede Silbe mehrere Male in kurzer Aufeinanderfolge wiederholt würde. Eine Flöte hatte dieselbe Wirkung, wie die menschliche Stimme, während eine Violine geringere und eine Trommel gar keine Wirkung zeigte. Am deutlichsten traten die Erscheinungen der Tonabnahme und der Undeutlichkeit bei der menschlichen Stimme und den-

*) Philosophical Magazine. Ser. 5. Vol. VII. pag. 111.

jenigen musikalischen Instrumenten zu Tage, welche verhältnissmässig geringe Obertöne besitzen.

Je mehr solcher Luftströmungen vorhanden und je mächtiger dieselben sind, um so grösser wird die Undeutlichkeit sowohl des gesprochenen Wortes, als die einer gesungenen Note. Der ursprüngliche Schallstrahl, der auf den ersten Luftstrom trifft, wird theils reflektirt, theils durchgelassen. Der durchgelassene Schallstrahl wird wiederum von dem nächsten Luftstrom getheilt und so fort, bis alle Luftströmungen passirt sind. Da jedoch der reflektirte Schall auch wieder bei seinem Rückwege eine Luftwand trifft, die ihn theilt und reflektirt, so entstehen viele sekundäre Wellen, die das Ohr schliesslich treffen und die Deutlichkeit des ursprünglichen Tones verdecken. Luftströmungen von wechselnder Dichte veranlassen somit zuerst eine Abnahme der Tonstärke und dann eine Undeutlichkeit oder Verworrenheit desselben.

Hieraus erfolgt klar, dass man, um eine gute ungehinderte Fortpflanzung des Schalles zu ermöglichen, die Luftströmungen beseitigen muss.

Dass die Zerstörung derartiger Luftströmungen nun in Wirklichkeit die Akustik eines Raumes ausserordentlich begünstigt, hat Jaques durch seine Beobachtungen in der Musikhalle zu Baltimore bestätigt gefunden.

Die Ventilation jener Lokalität wird in der Weise ausgeführt, dass die frische, im Winter hinter der Bühne erwärmte Luft, horizontal über die Bühne streicht, über die Rampe und das Orchester geht, und dann diagonal in mässiger Bewegung nach dem Dache zieht, so dass die Bildung kleinerer aufsteigender Luftströmungen gehindert ist.

Die Akustik dieses Raumes wird als ausgezeichnet gerühmt; es ist den Sängern ungemein leicht auf der Bühne zu

singen und zu sprechen und selbst geringe Geräusche, wie z. B. tiefes Athmen und leises Flüstern auf der Bühne, werden im ganzen Saale gehört.

Diese vortreffliche Akustik rührt aber nur von der Beschaffenheit der Luft und nicht etwa von der Anordnung und dem Material der Wände oder anderen Ursachen her. Um dies zu beweisen, wurden während einer Vorstellung Personen an verschiedenen Plätzen des Zuschauerraumes ohne weitere Information aufgestellt, welche nur genau zu notiren hatten, wenn sie deutlich und wenn sie schlecht hörten.

In verschiedenen Intervallen wurde dann während des Abends die Ventilation unterbrochen, so dass die heissen Luftströme von der Rampe, dem Orchester und anderen Lichtquellen ungehindert aufsteigen konnten. Fast ausnahmslos lautete das Zeugniss der Hörer, dass zu Zeiten der Ton verschwommen und undeutlich gewesen sei und man bemerken konnte, dass das Publikum im ganzen Hause sich anstrengte, um zu hören. Die nach der Uhr gemachten Aufzeichnungen ergaben, dass diese Zeiten genau mit den Unterbrechungen der Ventilation zusammenfielen. Es ist ferner eine in der Theaterpraxis bekannte Erscheinung, dass ein Sänger oder ein Schauspieler auf der Probe, vor leerem Hause mit seinem Organ viel mächtiger wirkte, als am Abend während der Vorstellung bei besetztem Hause. Man pflegt diesen Unterschied den schallabsorbirenden Kleidungsstücken des Publikums zuzuschreiben, die keineswegs ohne Einfluss auf die Akustik sind, aber da auf den Proben die Rampenbeleuchtung fortfällt — bei den Schauspiel- und Klavierproben auch noch die Orchesterbeleuchtung, — so darf man, gestützt auf die Experimente des W. W. Jaques, die Einbusse, welche das Organ an Kraft, an Mächtigkeit und Glanz am Abend im Vergleich zur Probe erleidet, grösstentheils auf

Rechnung der heissen Luftströme stellen, welche von der Rampenbeleuchtung und den Lampen des Orchesters aufsteigen.

Die hier kurz erörterten Nachtheile der Gasbeleuchtung: die Ueberhitzung des Zuschauerraumes und der Bühne, welche das Publikum in Unbehagen versetzt und den Darsteller zu erschöpfenden Anstrengungen zwingt, der gesundheitsschädigende ermüdende Einfluss der Verbrennungsgase, die Schwierigkeit, die erhöhte Temperatur durch Ventilation zu mässigen, die Nothwendigkeit, die Theater in der milden Jahreszeit zu schliessen, die heissen Luftströmungen, welche den Ton schwächen und Schuld daran sind, dass in den ersten Parquetreihen meistens am wenigsten gut gehört wird, sie alle drängen im Interesse des Publikums, der Darsteller, ja der Kunst selbst, auf eine Reform der Theaterbeleuchtung.

Durch die geniale Erfindung von Thomas Alva Edison, durch das elektrische Glühlicht, ist diese Reform zu verwirklichen.

Bei einer stündlichen Lichterzeugung von 100 Kerzen entwickelt ein Leuchtgas-Argandbrenner 4860 Wärmeeinheiten, ein Leuchtgas-Zweilochbrenner 12150 Wärmeeinheiten, das elektrische Glühlicht dagegen nur 290—536 Wärmeeinheiten.*) Diese Zahlen bedürfen weiter keines Commentares!

Das elektrische Glühlicht, nach dem System Edison, entwickelt bei gleicher Lichtstärke verhältnissmässig geringe Wärmemengen und ist frei von jeglichen Verbrennungsprodukten, ebenso wie es der Luft keinen Sauerstoff entzieht. Durch diese seine nicht hoch genug anzuschlagenden Eigenschaften ist es frei von den Nachtheilen der Gasbeleuchtung und hat nicht die Uebelstände im Gefolge, von denen im Vorangehenden gesprochen wurde.

*) Vergl. Veröffentlichung der Deutschen Edison Gesellschaft I. „Das Edison-Glühlicht und seine Bedeutung für Hygiene und Rettungswesen." S. 9.

Das Glühlicht schmälert nicht den Genuss des Theaterbesuchers, da es den Aufenthalt in den elektrisch beleuchteten Räumen zu einem angenehmen macht. Es erleichtert dem Darsteller die Ausführung seiner Aufgabe. Die Schauspieler derjenigen Theater, welche bis jetzt das Glühlicht eingeführt haben, sind glücklich darüber, von der Zughitze der Rampenbeleuchtung erlöst zu sein.

Das Glühlicht giebt den Theatern die Annehmlichkeiten wieder, welche das Gaslicht ihnen genommen hat.

Das elektrische Glühlicht erhöht die festliche Stimmung durch seinen reinen, sonnigen Glanz, den es ausstrahlt, ohne die Luft zu erhitzen und zu verderben.

Es erleuchtet die Bühne mit wohlthuender Klarheit, deren Dekorationen es nicht wie das Gaslicht durch Russabsatz verdirbt. Es ist dem Auge wegen seiner Ruhe angenehmer, als das zuckende, flackernde Gaslicht, und macht deshalb nervöse Personen nicht noch nervöser, wie jenes. Es überhitzt die Räume nicht und schreckt das Publikum beim Eintritt der milden Jahreszeit nicht vom Theaterbesuche ab, wie das Gaslicht. Das Publikum, welches einmal die Wohlthat der Beleuchtung von Theatern mittelst Glühlicht empfunden hat, wird dieselbe nicht mehr entbehren wollen; diejenigen Theater, Konzertsäle und geselligen Zusammenkünften dienenden Etablissements, welche das Glühlicht einführten, haben ihrer Konkurrenz einen gewaltigen Vorsprung abgewonnen, indem sie die Bedürfnisse der Zeit erkannten.

Die von Tag zu Tag zunehmende Verbreitung des elektrischen Glühlichts wird zur Folge haben, dass das Publikum sich mit den Annehmlichkeiten und Vortheilen desselben mehr und mehr vertraut macht. Es kann daher nicht ausbleiben,

dass das Publikum das Verlangen stellt, an dem Fortschritt zu participiren, den das Glühlicht auf dem Gebiete des Beleuchtungswesens repräsentirt.

Man wird nach nicht gar langer Zeit die Frage aufwerfen, wie es möglich war, in nicht elektrisch beleuchteten Theatern auszuhalten um an den Kunstleistungen ungetrübten Genuss zu finden? Es wird sich herausstellen, dass durch die Beleuchtung der Theater mit elektrischem Glühlicht Alle gewinnen: das Publikum, die Künstler, die Direktionen und — die Kunst, welche ein empfänglicheres Publikum und schaffensfreudigere Darsteller findet. —

Die praktischen und technischen Erfahrungen, welche bis jetzt bei den Glühlichtanlagen verschiedener Theater gemacht worden sind, werden uns auf den folgenden Seiten beschäftigen; sie geben dem Fachmann nicht nur, sondern auch jedem sich Interessirenden Auskunft über die Installirung des Glühlichtes in Theatern.

Die elektrische Beleuchtung des Stadttheaters in Brünn.*)

Brünn ist mit seinen 90 000 Einwohnern und seinen zahlreichen Tuch- und Lederfabriken eine der bedeutendsten Fabrikstädte Oesterreichs; wir dürfen uns daher nicht wundern, in einer so reichen Stadt ein Theater von solcher Grösse und Schönheit zu finden, dass es einer Hauptstadt würdig wäre. Das Theater ist von allen vier Seiten frei und steht inmitten schöner Parkanlagen, welche auf dem Terrain der im Jahre 1860 niedergelegten Festungswerke angelegt sind; es ist an die Stelle eines im Jahre 1871 errichteten Interimstheaters getreten und nach den Plänen der Wiener Architekten Fellner und Helmer ausgeführt worden. (Tafel Fig. 1.) Der Bau lässt schon im Aeusseren das Theater in seinen Haupträumlichkeiten, der Vorhalle mit Treppenhaus, dem Zuschauerraum und dem überhöhten Bühnenraume, erkennen.

Der Zuschauerraum besteht aus dem Parquet, drei Rängen und dem Amphitheater, ist durchweg für Sitzplätze eingerichtet und kann 1200 Personen fassen. Ursprünglich war derselbe für 1500 Personen berechnet; infolge des Brandes des Wiener Ring-Theaters sind jedoch die Gänge bedeutend verbreitert und daher die Sitzplätze verringert worden. Aus demselben Grunde wurden auch an Stelle von zwei Seitentreppen des ersten Entwurfes deren vier angebracht. Der ganze Zuschauerraum ist in hellen Farbentönen gehalten und reich mit Ver-

*) Auszug aus dem im Märzheft 1883 der Zeitschrift des Vereins deutscher Ingenieure enthaltenen Artikel: „Die elektrische Beleuchtung des Savoy-Theaters in London und des Stadttheaters in Brünn.“

goldung versehen; die innere Ausschmückung der Logen, ferner die Draperien sowie die gesammten Sitzplätze sind im kräftigen Dunkelroth gehalten.

Das Bühnenhaus ist von dem übrigen Gebäude durch 1 bis 1,5 m dicke Wände und von dem Zuschauerraum durch einen eisernen Vorhang getrennt. Dasselbe besteht aus der Hauptbühne, dem Schnürboden, der Unterbühne, der durch einen eisernen Vorhang von der Hauptbühne getrennten Hinterbühne und den zu beiden Seiten der letzteren gelegenen Decorationsmagazinen. Der Schnürboden und die Unterbühne haben ungefähr die Höhe der Hauptbühne.

Eine Einrichtung für Gasbeleuchtung ist in dem ganzen Hause nicht vorhanden. Glücklicherweise entschloss sich der Brünner Gemeinderath auf Betreiben des Bürgermeisters Winterholler noch rechtzeitig, nicht Gas-, sondern die elektrische Beleuchtung einzuführen. Man muss diesen kühnen Entschluss um so mehr bewundern, als damals die Resultate der Münchener Versuche der Theaterbeleuchtung noch nicht vorlagen. Nun, meine Herren, wer die Anlage gesehen und sich von ihrer Vortrefflichkeit überzeugt hat, wird erkannt haben, dass der Brünner Gemeinderath seinen Entschluss nicht zu bereuen hat, vielmehr seinem thatkräftigen Bürgermeister danken muss, dessen rastlosem Bemühen das Gelingen der ganzen Sache zu verdanken ist.

Die elektrische Beleuchtungsanlage des Theaters wurde gemeinschaftlich ausgeführt von der Commandit-Gesellschaft für angewandte Elektricität Brückner, Ross & Consorten in Wien und der Société électrique Edison in Paris, auf Grund eines Vertrages, dessen wesentlichste Punkte später mitgetheilt werden sollen.

Die Beschreibung der ganzen Anlage will ich in vier Abschnitte theilen.

1. Maschinen-Anlage.

Das Maschinenhaus ist ungefähr 300 m von dem Theater entfernt. Ueber die Maschinen-Anlage (Tafel Fig. 2 und 3) entnehme ich einem Vortrage des Hrn. Burghardt, Baurath der Stadt Brünn, die folgenden Angaben:

Der bauliche Theil der Anlage zerfällt in das Kesselhaus mit 129 qm benutzbarer Grundfläche und das Maschinenhaus mit 120 qm Grundfläche. Im Kesselhaus befinden sich drei neben einander eingemauerte Röhrendampfkessel, System Dupuis. Jeder dieser Kessel besteht im wesentlichen aus einem horizontalen Vorderkessel (4 m Länge, 1,1 m Durchmesser) und einem angeschlossenen stehenden Röhrenkessel (2,06 m Höhe, 1,63 m Durchmesser), in welchem letzteren sich vier Gruppen Röhren, zusammen 68 Röhren von je 76 mm äusserem Durchmesser befinden. Die gesammte Heizfläche jedes dieser Kessel berechnet sich auf 55 qm, und da für den regelrechten Betrieb der Dampfmaschine zwei Kessel genügen, so verbleibt immer ein Kessel für die Aushülfe. Der unter dem Vorderkessel liegende Planrost hat eine Länge von 1,265 m bei 1 m Breite; das Verhältnis der Rostfläche zur Heizfläche ist daher 1 : 44.

Die mit allen erforderlichen Heiz- und Sicherheits-Armaturen ausgestatteten Kessel werden durch eine Wanddampfpumpe mit Wasser der städtischen Wasserleitung gespeist, welches dieselbe aus einem kleinen druckfreien Behälter ansaugt und durch einen Druckröhren-Vorwärmer in die Kessel befördert. Letzterer wird von dem Abdampf der Dampfmaschine durchströmt und bietet demselben eine Heizfläche von 15,6 qm, welche genügt, um das Speisewasser bis 90° C. vorzuwärmen. Zur grösseren Sicherstellung der Kesselspeisung ist am genannten Wasserbehälter eine Schäffer- und Budenberg'sche Strahlpumpe angeschlossen, deren Druckleitung mit

der Speiseleitung in Verbindung steht. Die Dampfkessel sind auf sieben Atmosphären Betriebsspannung concessionirt, welche Spannung auch als zulässiger Druck für die Dampfmaschine in Aussicht genommen ist.

Behufs Rauchverzehrung sind über den Rosten der Kessel eigen construirte Dampfgebläse angebracht, welche zur Zeit der frischen Beschickung der Roste in Thätigkeit gesetzt werden. Die den Kesseln gemeinsame Esse hat 30 m Höhe.

Die Dampfmaschine, eine 110 pferdige Hochdruckdampfmaschine (System Collmann), Zwilling mit Kurbeln unter 90°, von 350 mm Durchmesser, 800 mm Hub der Kolben und 105 Umdrehungen in der Minute, zeichnet sich durch ruhigen Gang aus; die Steuerung wirkt, selbst bei 105 Umdrehungen in der Minute, äusserlich bisher tadellos.

Auf der gemeinsamen Welle ist das Seilschwungrad von 4 m Durchmesser angeordnet, welches die Vorlegewelle mit sieben Hanfseilen von je 40 mm Durchmesser treibt.

Bei einer mittleren Spannung von 1,8 kg pro qcm, welche einer 6- bis 7fachen Expansion entspricht, ergiebt sich eine indicirte Leistung von 65 Pferdekräften für jeden Cylinder; im Falle einer Reparatur der einen Maschinenhälfte kann die andere durch stärkere Füllung auf etwa $^1/_4$ bis zu $^2/_3$ der gesammten Leistung herangezogen werden.

Vermittelst der sieben Hanfseile wird die gesammte Kraft der Dampfmaschine auf eine Seilscheibe von 1,1 m Durchmesser und die parallel einer Wand des Maschinenhauses laufende Transmissionswelle übertragen, welche demnach 300 Umdrehungen in der Minute macht. Von der Transmissionswelle aus wird die Bewegung mittelst baumwollener durchsteppter Riemen, welche in Gabeln laufen, auf die im Maschinenraume befindlichen vier Edison'schen und zwei Gramme'schen Dynamomaschinen übertragen. Von letzteren dient die grössere (fünfpferdige) zum Betriebe von fünf vor dem Theater aufgestellten Bogenlichtern, die kleinere (zweipferdige) zur Erzeugung von Effektbeleuchtungen (z. B. zur Nachahmung von Mondschein durch elektrisches Bogenlicht) auf der Bühne. Es soll noch eine dritte Gramme'sche Maschine aufgestellt werden, welche den Strom für eine bereits auf dem Boden des Zuschauerraums aufgestellte, zum Betriebe eines Exhaustors dienende, secundäre Dynamomaschine liefern soll.

Die vier Edison'schen Dynamomaschinen (Modell *K*), welche im Stande sind, je 250 A-Lampen von je 16 Normalkerzen Lichtstärke zu speisen, haben die folgenden Dimensionen: der Widerstand des Ankers beträgt 0,0325 Ohm, der der Magnete 12,18 Ohm, die Stromstärke 183 Ampère, die Klemmenspannung 110 Volt. Es sind 64 Commutatorabtheilungen vorhanden. Jede Maschine wiegt 4000 kg und bedarf zu ihrem Betriebe 30 Pferdekräfte.

Die vier Maschinen, welche 900 Umdrehungen in der Minute machen, werden, da sie höchstens gleichzeitig 900 Glühlichtlampen speisen, nicht auf das höchste Mass ihrer Leistung in Anspruch genommen. Eine Aushülfemaschine ist nicht vorhanden; sollte eine der Maschinen versagen, so werden die übrigen in entsprechend höherem Masse beansprucht.

Die elektrische Anordnung der Maschinen ist aus der schematischen Skizze (Tafel Fig. 4) zu ersehen. Die vollausgezogenen Linien bedeuten den Hauptstromkreis, die punktirten den Erregungsstromkreis. Die vier Maschinen sind parallel geschaltet; ihre Elektromagnete werden durch vier ebenfalls parallel geschaltete Zweigströme erregt. Der in jeder Maschine erzeugte Strom durchläuft eine an der Wand des Maschinenhauses angebrachte Schaltvorrichtung, unterhalb welcher sich die Drähte zu einem gemeinsamen Strange ver-

einigen. Eine gleiche Schaltvorrichtung ist für den Erregungsstromkreis vorhanden. Zur Regulirung der elektromotorischen Kraft der Maschine werden Widerstände aus Neusilberdraht mittelst eines Kurbeleinschalters in den Erregungsstromkreis eingeschaltet.

2. Kabel.

Der in den vier Maschinen erzeugte Strom wird in einem Stromkreise zu dem Theater geleitet. Es dienen hierzu die bekannten Edison-Kabel (Textfigur 1), in welchen Hin- und Rückleitung gemeinsam in einem Eisenrohr, welches im vorliegenden Falle einen Durchmesser von 76 mm hat, eingeschlossen sind. Die Leitungen bestehen aus halbmondförmigen Kupferbarren, welche von einander und von der Eisenröhre durch eine Isolirmasse von eigenartiger Zusammensetzung getrennt sind. Diese Kabel können wie Gasleitungsröhren in die Erde versenkt werden und liegen in Brünn 1 m tief. Die einzelnen zur Verwendung kommenden Röhren haben eine Länge von 6 m; die ungefähr 5 cm an jedem Ende hervorragenden Kupferbarren werden mit denen des nächsten Rohres durch U-förmige Bügel verbunden, um eine Ausdehnung und Zusammenziehung der ganzen Leitung zu gestatten. Siehe Textfigur 2.

Fig. 1

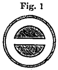
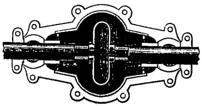


Fig. 2

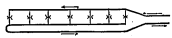


Beim Legen der Kabel wird folgendermassen verfahren. Die hervorragenden Kupferenden werden sorgfältig gereinigt und sodann zwei Rohrstücke so aneinander gelegt, dass zwischen den Kupferenden ungefähr ein Zwischenraum von 5 cm bleibt. Die kupfernen U-förmigen Bügel werden darauf mittelst Schrauben an den Kupferenden befestigt. Um aber einen auf alle Fälle sicheren Contact zu erzielen, werden die Kupferstücke im Wasserstoffstrom zusammengelöthet. Alsdann wird die Verbindungsstelle mit einem gusseisernen Kasten umgeben, dessen Inneres, nachdem man zwischen die beiden Pole ein mit Paraffin getränktes Kartenblatt gelegt hat, mit Isolirmasse ausgegossen wird.

3. Einrichtung im Theater.

Im Theater befinden sich rund 1400 Edison'sche A-Lampen von 16 Normalkerzen Lichtstärke, welche sämmtlich parallel geschaltet sind (s. Textfigur 3). Das den Strom zuführende Kabel mündet im Keller und wird hier gleich in zwei Stromkreise getheilt. In den einen derselben, die sogenannte Hausleitung, sind alle diejenigen Lampen eingeschaltet, welche während ihrer ganzen Brenndauer einer Aenderung der Lichtstärke nicht bedürfen, also die Lampen zur Erleuchtung der Vorhalle, der Treppenräume, Flure u. s. w.; ihre Zahl beträgt 369.

Fig. 3.



In den zweiten von der Hauptkabelleitung abgezweigten Stromkreis sind die sämmtlichen Lampen eingeschaltet, welche

im Laufe des Abends einer Regulirung bedürfen, also die im Bühnen- und Zuschauerraum angebrachten Lampen.

Zur Beleuchtung der Bühne bei den im Laufe des Tages abzuhaltenden Proben dienen 40 Edison'sche B-Lampen von je 8 Normalkerzen Lichtstärke, welche durch eine im Keller aufgestellte, kleine Gramme'sche Maschine gespeist werden, zu deren Betrieb ein auch zur Bewegung eines Ventilators bestimmter sechspferdiger Otto'scher Gasmotor dient. Als besonders bemerkenswerth sei hier erwähnt, dass die den Raum dieses Gasmotors erleuchtende Flamme die einzige im ganzen Theater vorhandene Gasflamme ist.

Die Vertheilung sämmtlicher Lampen ist etwa folgende:

Maschinenhaus		8
Hausleitung:		
Erdgeschoss	8	
Parterre, vordere Leitung einschl. der Vorhalle	118	
„ hintere Leitung	10	
Mezzanin, vorn	18	
„ hinten	30	
I. Rang, vorn einschl. Foyerbeleuchtung	79	
„ hinten	10	
II. Rang	17	
III. Rang, vorn einschl. der Kronleuchter im Prachttreppenhaus	40	
„ hinten	34	
Amphitheater	5	
		369

Transport		369
Bühnen- und Zuschauerraum:		
6 Soffitten zu je 101	606	
Rampe rechts	71	
„ links	71	
Portalcoulisse links	30	
„ rechts	30	
4 Versetzstücke zu je 8	32	
Orchester	23	
Zuschauerraum I. Rang	22	
II. Rang	20	
III. Rang	21	
Amphitheater	18	
Kronleuchter	56	
Unterbühne } nicht regulirbar	13	
Souffleur } nicht regulirbar	2	
		1015
Probenbeleuchtung:		
1 Soffitte	15	
Souffleur	2	
Orchester	23	
		40
Im ganzen		1432

Die Theilung des durch das Kabel zugeführten Stromes geschieht mittelst einer Schaltvorrichtung (s. Tafel Figur 5), in welcher die mit einer Fahne versehenen Pfeile den nicht regulirbaren, in der Zeichnung als geöffnet dargestellten Stromkreis (Hausleitung), und die mit zwei Fahnen versehenen Pfeile den regulirbaren, als geschlossen dargestellten Stromkreis bedeuten. Die mit *Bs* bezeichneten Bleistreifen haben den Zweck, im Falle eines kurzen Schlusses in der Leitung eine Erhitzung derselben zu vermeiden. Entsteht nämlich durch irgend einen

Zufall ein kurzer Schluss, d. h. eine directe Verbindung der Hin- und Rückleitung, so muss, da plötzlich ein grosser Widerstand ausgeschaltet wird, in den beiden Drähten eine starke Erhitzung stattfinden; dieselbe pflanzt sich bei der grossen Wärmeleitungsfähigkeit des Kupfers sehr schnell fort und schmilzt den in die Leitung eingeschalteten Bleistreifen durch, wodurch der Strom unterbrochen wird, bevor eine feuersgefährliche Erhitzung der Leitungen eintritt. Da natürlich eine solche Bleisicherung nicht zu weit von einer gefährdeten Stelle entfernt sein darf, so ist im Brünner Theater die Anordnung getroffen, dass bei jeder Abzweigung einer Leitung immer eine solche Bleisicherung eingeschaltet, mindestens aber je eine Gruppe von 6 bis 10 Lampen mit einer solchen versehen ist.

Die Hausleitung steigt senkrecht vom Keller bis zum Amphitheater empor. In jedem Range sind Abzweigungen angebracht, welche stets mit einer Bleisicherung *Bs* und mit einem Stöpseleinschalter *A*, wie in Fig. 6 dargestellt, versehen sind. Die Leitung verzweigt sich also astförmig durch das ganze Haus.

Die Leitung für den Bühnen- und Zuschauerraum geht unmittelbar vom Keller zum Regulirungsapparat, dem interessantesten und wichtigsten Theile der Anlage. Bevor die Leitung denselben erreicht, werden von derselben die 13 Lampen für die Unterbühne und die 2 Lampen für den Souffleur abgezweigt, da dieselben einer Regulirung nicht bedürfen.

Zur Beschreibung des Regulirungsapparates übergehend, muss ich noch bemerken, dass die Lampen einer jeden Soffitte, Rampe und Coulisse in drei Stromkreise eingeschaltet sind, und zwar ist jede zweite bezw. dritte Lampe mit einer elastischen Gelatinehülle von rother bezw. grüner Farbe überzogen, um dadurch das zu verschiedenen Bühnenzwecken erforderliche

farbige Licht hervorbringen zu können. Da also von sämmtlichen Soffitten-, Rampen- und Coulissenlampen nur der dritte Theil zu gleicher Zeit brennt, so sind immer nur ungefähr 900 Lampen im Betriebe. Am Boden der Bühne und auf dem Schnürboden sind je sechs Paar Polklemmen angebracht, von welchen aus der Strom den Versetzstücken durch biegsame Leitungen zugeführt wird.

Die in den Fig. 7 und 8 schematisch dargestellte Einrichtung des Regulirungsapparates ist eine ziemlich verwickelte, da bei einem Theater, welches, wie das Brünner, allen Kunstgattungen dienen muss, in dem bald eine Posse, bald eine Tragödie oder eine grosse Oper gegeben wird, eine möglichst vielseitige Regulirung der einzelnen Beleuchtungsabtheilungen möglich sein muss. Die Einrichtung besteht im wesentlichen darin, dass der Hauptstrom in so viel Stromkreise getheilt wird, als aus bühnentechnischen Rücksichten erforderlich sind, nur dass in dieselben mittelst eines Kurbeleinschalters je nach der gewünschten Lichtstärke der Lampen Widerstände eingeschaltet werden. Der Regulirungsapparat ist rechts auf der Bühne an der Wand, welche dieselbe von dem Zuschauerraume trennt, ungefähr 2 m über dem Fussboden angebracht. Wie man aus der Fig. 10 leicht ersieht, ist im vorliegenden Falle für die Lampen jeder einzelnen Soffitte, der sämmtlichen Soffitten auf einmal, jeder Rampenhälfte, jeder Coulisse, der ganzen Bühne auf einmal, der Versetzständer auf der Bühne, der Versetzständer auf dem Schnürboden, endlich für die Lampen des Orchesters und die des Zuschauerraumes eine besondere Regulirungsvorrichtung vorhanden.

Um ein Bild von der Einrichtung des Regulirungsapparates im einzelnen zu bekommen, ist der Stromlauf für die erste Soffitte ausführlich dargestellt.

Die Kurbeleinschalter *a* und *b* (vergl. Tafel Figur 7 u. 8) sind auf einem Tische derart angebracht, dass sie leicht gehandhabt werden können; an der Rückwand sind die einfachen Einschalter *c* und *d* und über denselben die Drahtwiderstände *e* und *f* befestigt. Der vom Hauptstrom abgezweigte Strom dient entweder, wenn der Stromkreis durch den Einschalter *c* geschlossen, dagegen der Stromkreis der rothen oder der grünen Lampen geöffnet ist, zur Speisung der weissen, im entgegengesetzten Falle zur Speisung der farbigen Lampen.

Nehmen wir nun, wie es in der Fig. 7 dargestellt ist, an, der Stromkreis zu den weissen Lampen sei geschlossen und behufs Dämpfung der Lampen mittelst des Kurbeleinschalters der halbe Drahtwiderstand *e* eingeschaltet, so wird der Strom, nachdem er die Bleisicherung *Bs* durchflossen hat, in den Kurbeleinschalter *a* eintreten. Letzterer gestattet Drahtwiderstand in 29 verschiedenen Abstufungen in den Lampenstromkreis einzuschalten. Der Strom, welcher in das Contactstück *m* eintritt und durch die Achse der Schleifkurbel austreten muss, nimmt, da eine unmittelbare Verbindung zwischen letzterer und *m* fehlt, den Weg durch die Drähte des Widerstandrahmens *e* und tritt durch das Contactstück *n* in die Kurbel. Diese verlässt er durch ihre Achse und geht, nachdem er den Einschalter *c* durchflossen hat, in die weissen Lampen. Der Lauf des Stromes ist in der Zeichnung durch Pfeile mit zunehmender Anzahl der Fahnen bezeichnet. Wird der Strom umgeschaltet, so dass er durch die rothen oder grünen Lampen geht, so durchfliesst er, entsprechend wie oben beschrieben, die Bleisicherung *Bs*, den Kurbeleinschalter *b* und den Drahtwiderstand *f*.

Die 900 Lampen, welche jeden Abend im Betriebe sind, liefern übrigens meist weniger als $900 \times 16 = 14400$ Normalkerzen, da eine gewisse Anzahl der Lampen, z. B. die des

Zuschauerraumes, während gespielt wird, weit unter ihrer normalen Lichtstärke brennen.

Die sämmtlichen Glühlichtlampen des Zuschauerraumes sind mit eiförmig gestalteten Milchglasglocken umgeben, welche das Licht leider um etwa 40 pCt. abschwächen. Eine Dämpfung des Lichtes, welche im vorliegenden Falle offenbar eine zu starke ist, ist gegen den Willen der Elektrotechniker auf besonderen Wunsch der Architekten geschehen, weil letztere befürchteten, dass man bei ungedämpften Lampen zu viele Schäden an ihrer Decoration, namentlich an der Vergoldung, entdecken würde. Ebenso sind die meisten Lampen an den Kronleuchtern im Treppenhaus und im Foyer mit Milchglasglocken versehen. Dagegen spenden die in der Vorhalle an äusserst geschmackvollen zweiarmigen Trägern angebrachten und die in den Fluren vorhandenen Lampen ihr volles Licht. Die Brenndauer der Glühlampen soll mindestens 700 Stunden betragen.

Als Nothbeleuchtung dienen 80 von aussen ventilirte Laternen, welche sehr geschickt vertheilt sind.

4. Beleuchtung des Platzes vor dem Theater.

Hierzu dienen fünf Gramme'sche, durch die fünfpferdige Dynamomaschine desselben Erfinders gespeiste Bogenlichtlampen von je 1000 Normalkerzen. Gerade wie beim Savoy-Theater in London wird der Platz vor dem Theater zweckmässigerweise durch Bogenlicht erleuchtet. Es ist durchaus falsch, die Glühlichtbeleuchtung gegen die Bogenlichtbeleuchtung in den Kampf zu führen; beide Beleuchtungsarten können friedlich neben einander bestehen. Das Bogenlicht, weil es billig grosse Lichtquellen liefert, wende man zur Beleuchtung von freien Plätzen, Bahnhofshallen, grossen Fabrikräumen und

dergl. an, den Glühlichtern lasse man die geschlossenen und besonders solche Räume, bei denen es auf eine angenehme und wirksame Beleuchtung ankommt.

Zum Schlusse möchte ich nun ausführlich auf die Vorzüge der elektrischen Glühlichtbeleuchtung gegenüber der Gasbeleuchtung eingehen.

Die Lichtwirkung der Glühlampen ist eine ausserordentlich glänzende; sie geben ein angenehmeres und weisseres Licht als Gas. Die Farben werden weniger verändert als durch das Gaslicht; denselben wird ein besonders warmer Ton verliehen, und selbst kältere Farbentöne gelangen zu lebhafterer Wirkung. Einer Verbindung von Bogenlicht und Glühlicht zur Beleuchtung von geschlossenen Räumen, wie solche im Münchener Theater stattgefunden und aus ökonomischen Gründen empfohlen wird, möchte ich nicht das Wort reden. Das Bogenlicht, selbst wenn es, wie in München, durch matte Scheiben gemildert wird, ruft immer kalte Farbentöne hervor, welche Thatsache gerade bei einer Verbindung beider Beleuchtungsarten besonders hervortreten muss. Entschliesst man sich einmal zur Einführung der elektrischen Beleuchtung, so beleuchte man geschmückte Räume, um sie zu voller Wirkung zu bringen, ausschliesslich mit Glühlampen. Ein weiterer Vorzug der letzteren besteht in der Ruhe und Gleichmässigkeit, mit der sie brennen; dies macht sich besonders auf der Bühne angenehm bemerkbar, wo sonst die vielen offen brennenden Gasflammen durch ihr Flackern die Schauspieler sehr belästigen.

Infolge der geringen Wärmeentwicklung der Glühlampen nimmt die Temperatur im Laufe des Abends nur sehr wenig zu. Bei einem fast vollen Theater in Brünn betrug die Temperatur am Anfange der Vorstellung im Parquet 16° R., im

Amphitheater 15,5° R., gegen Ende der Vorstellung entsprechend 15,5° R. und 17° R. Die Temperatur war also während der Vorstellung unter dem Dache nur um 1,5° R. gestiegen! Im Savoy-Theater betrug die Temperatur bei ausverkauftem Hause und gegen Ende der Vorstellung ebenfalls nur 17° R. Die Luft im Theater behält aber nicht nur eine angenehme Temperatur, sondern sie wird auch nicht verdorben wie dies bei der Gasbeleuchtung durch die Verbrennungsproducte des Gases der Fall ist*). Die elektrische Beleuchtung wird daher in gesundheitlicher Hinsicht sowohl auf die Zuschauer als auch namentlich auf das Bühnenpersonal einen sehr günstigen Einfluss ausüben.

Aus diesen Eigenschaften des elektrischen Lichtes folgt ferner mit Nothwendigkeit, dass die Decorationen und Malereien viel länger erhalten bleiben und daher die Kosten für Erneuerung, bezw. Ausbesserung derselben bedeutend vermindert werden. Und in der That, das Savoy-Theater, welches doch bereits vor $1^1/_4$ Jahren eröffnet worden ist, macht in seinen Innenräumen den Eindruck, als wenn es eben aus der Hand des Architekten hervorgegangen wäre. Die schädliche Wirkung der Gasbeleuchtung dagegen kann, wenn es sich nicht nur um gewöhnliche Decorationsgegenstände handelt, sehr grosse, oft unersetzbare Verluste herbeiführen. So sind z. B. im Foyer der grossen Pariser Oper einige der von ersten Meistern ausgeführten Deckengemälde schon nach wenigen

*) Wie wenig die Luft bei Anwendung elektrischer Beleuchtung verschlechtert wird, geht wohl am besten aus der Thatsache hervor, dass im Brünner Theater, welches bereits, als man sich zur Einführung der elektrischen Beleuchtung entschloss, mit einer ausgezeichneten Ventilationseinrichtung versehen war, weder der im Keller aufgestellte Ventilator, noch der im Dachgeschosse befindliche Exhaustor für gewöhnlich benutzt wird. Nur Sonntags, wenn eine Nachmittagsvorstellung stattfindet, wird zwischen der ersten und zweiten Vorstellung der Ventilator auf eine halbe Stunde in Betrieb gesetzt.

Jahren durch Ablagerung einer Schicht von Ausscheidungsstoffen, von der Gasverbrennung herrührend, fast gänzlich vernichtet worden.

Ein Hauptgrund zur Einführung der elektrischen Beleuchtung in Theatern liegt in ihrer grossen Sicherheit gegen Feuersgefahr.

Die Construction der Glühlampen schliesst die Möglichkeit, dass ein in ihre Nähe gebrachter, leicht brennbarer Körper Feuer fangen könnte, aus. Bricht die Glasglocke entzwei, so erlischt die Lampe infolge Verbrennens des Kohlenbügels augenblicklich. Eine Entzündung in der Nähe befindlicher, leicht brennbarer Körper tritt, wie Versuche gezeigt haben, selbst in diesem Falle nicht ein. Durch die Leitungen kann Feuersgefahr nicht entstehen, wenn die Anlage so sorgfältig ausgeführt ist, wie im Savoy- und im Brünner Theater, d. h., wenn eine genügende Anzahl Bleisicherungen in den Leitungen vorhanden ist. Tritt in diesem Falle dann an irgend einer Stelle der Leitung durch kurzen Schluss eine Erhitzung der Leitungen ein, so schmilzt der zunächst eingeschaltete Bleistreifen ab, bevor der Draht zum Glühen kommt. In Brünn hat man sich durch Versuche überzeugt, dass bei einem Kurzschluss in der That diese Sicherheitsvorrichtung richtig wirkt. Die sämmtlichen von Hrn. Schilling im Journal für Gasbeleuchtung 1882 Bd. 25 S. 639 u. f. angeführten Brände, welche auf ein Glühendwerden von Leitungen zurückgeführt werden, sind entweder vor dem Bekanntwerden der Bleisicherungen entstanden, oder aber man hat die Benutzung der letzteren versäumt. Auch das von Hrn. Schilling vorgeführte Bedenken gegen elektrische Beleuchtung dürfte hinfällig sein, dass bei ausbrechendem Feuer diese Beleuchtung sogleich gänzlich versage; die Leitungen selbst sind mindestens nicht mehr gefährdet, als die Rohrleitungen der Gasbeleuchtung, und die

Zerstörung der einzelnen Lichter kann nur in dem Masse allmählich erfolgen, wie das Feuer um sich greift.

Man bedenke nun, wieviel leichter in einem durch Gas erleuchteten Theater Feuersgefahr entstehen kann. Hier brennen offene Gasflammen, die nur durch breitmaschige Drahtgitter von den brennbarsten Stoffen getrennt sind. Ich möchte Sie, m. H., daran erinnern, wieviel Tänzerinnen schon an den Rampenlichtern Feuer gefangen und zum Theil elendiglich verbrannt sind. Und wie gefährlich ist das Anstecken der Gasflammen, welches gewöhnlich durch kleine, auf einer Stange befestigte Spirituslampen geschieht; soll doch auch das grosse Wiener Unglück durch Unvorsichtigkeit beim Anstecken der Soffittenflammen entstanden sein*). A. Fölsch giebt in seinem Buch über Theaterbrände an, dass diese meistens durch offenes oder schlecht geschütztes Licht entstanden sind. Eine ganze Reihe von Bränden sind ferner durch Gasexplosionen verursacht. Die auf der Bühne befindlichen, meist offen liegenden Gasröhren sind verhältnissmässig leicht einer Beschädigung ausgesetzt; sehr häufig entsteht Feuersgefahr durch ein Undichtwerden oder Zerreissen der Schläuche, welche den Versetzstücken das Gas zuführen.

Die Gefahr, dass Menschen durch den Strom infolge irgend eines Zufalles erschlagen werden könnten, ist bei der geringen Spannung des bei der Glühlichtbeleuchtung in Anwendung kommenden Stromes überhaupt ausgeschlossen.

*) Dass auch die Feuerversicherungsgesellschaften von der grösseren Feuersicherheit der elektrischen Beleuchtung überzeugt sind, geht wohl am besten aus der Thatsache hervor, dass die Prämien sowohl des Savoy-Theaters als des Brünner Theaters niedriger sind als bei Verwendung von Gasbeleuchtung. Bei letzterem Theater beträgt die Prämie 12 anstatt wie früher 15 auf Tausend.

Der Director einer unserer grösseren Bühnen, welcher ebenfalls das Brünner Theater eingehend besichtigt hat, sprach mir gegenüber seine Ansicht dahin aus, dass die elektrische Beleuchtungsanlage desselben allen den Erfordernissen entspräche, welche man an eine Bühnenbeleuchtung stellen müsse. Er meinte nur, dass sich die Herstellung der farbigen Lampen durch Ueberziehen derselben mit Gelatinehüllen nicht bewähren würde, und dass man besser thun würde, die Glühlampen gleich aus farbigem Glase herzustellen. Mein Gewährsmann lobte besonders die Ruhe und Gleichmässigkeit des Lichtes und meinte, dass die neue Beleuchtungsart wegen ihrer geringen Wärmeentwicklung besonders einen günstigen Einfluss auf den Gesundheitszustand der Schauspieler ausüben müsse. Die elektrische Glühlichtbeleuchtung sei unzweifelhaft die zukünftige Beleuchtung der Bühnen.

Um Ihnen, m. H., noch einen weiteren Beweis für die Brauchbarkeit der Glühlichtbeleuchtung zu geben, erlaube ich mir, Ihnen einen Abschnitt aus einem Berichte vorzulesen, welchen die kaiserl. Generaldirection der Reichseisenbahnen über die in grösserem Massstabe mit elektrischer Beleuchtung ausgeführten Versuche veröffentlicht hat. Es heisst in demselben: „Die Generaldirection glaubt aus den vorliegenden Ergebnissen schliessen zu dürfen, dass die elektrische Beleuchtung im allgemeinen bezüglich der Kostenfrage mit der Gasbeleuchtung in wirksamen Wettkampf treten kann, und dass insbesondere die Glühlichtbeleuchtung wegen ihrer Gefahrlosigkeit, wegen der geringen Wärmeentwicklung der Lampen, wegen der Ruhe, Gleichförmigkeit und angenehmen Färbung des Lichtes, sowie schliesslich wegen der bequemen Unterhaltung der Beleuchtungseinrichtungen für geschlossene Räume, Wartesäle und Bureaux den Vorzug vor jeder anderen Beleuchtungsart verdient“.

Auf diesen Bericht der kaiserl. Generaldirection ist meiner Meinung nach der grösste Werth zu legen, da wir in demselben ein unparteiisches, nicht durch geschäftliche Interessen beeinflusstes Urteil finden. Die kaiserl. Generaldirection beabsichtigte lediglich, durch ihre Versuche die beste Beleuchtungsart für den neuen Bahnhof in Strassburg ausfindig zu machen.

Als Nachtheil der elektrischen Beleuchtung wird angegeben, dass dieselbe nicht so grosse Betriebssicherheit biete wie die Gasbeleuchtung. Aber, m. H., würde sich der Besitzer des Savoy-Theaters, in welchem eine vollständige, jeden Augenblick brauchbare Gaseinrichtung vorhanden ist, nachdem er die elektrische Beleuchtung ein Jahr lang in seinem Theater erprobt hatte, wohl entschlossen haben, dieselbe nun endgültig einzuführen, wenn dieselbe nicht die genügende Sicherheit geboten hätte? Ich möchte meinen, dass ein Jahr genüge, um alle möglichen Erfahrungen zu sammeln. Das Brünner Theater war ja freilich erst vier Wochen im Betriebe, als ich dort war. In dieser Zeit hatte die Beleuchtung aber nicht ein einziges Mal, auch nicht für Secunden, versagt. Und ich meine, die Unternehmer, welche die Einrichtung der Brünner Anlage übernommen hatten, mussten ihrer Sache wohl sehr sicher sein, denn sonst hätten sie die schweren Strafbestimmungen, welche im Vertrage mit der Stadt Brünn enthalten sind, nicht angenommen.

Ueber die Anlage- und Betriebskosten der beiden Anlagen kann ich Ihnen leider nicht so genaue und ausführliche Zahlen geben, wie es wünschenswerth wäre. Die Anlage- und Betriebskosten der provisorischen Anlage des Savoy-Theaters sind offenbar viel höher, als sie sein würden, wenn die Anlage einen dauernden Charakter trüge.

Die in technischen Kreisen vielfach verbreitete Meinung als sei die elektrische Beleuchtung viel theurer als die Gasbeleuchtung, halte ich nicht für eine richtige. In dem bereits vorher erwähnten Berichte der kaiserlichen Generaldirection haben die vergleichenden Versuche hinsichtlich der Kosten folgendes ergeben:

Es betragen die Kosten für die Brennstunde

						und Lampe	und Normalkerze
1.	einer	Differentiallampe	zu	1200	N.-K.	64,64 Pf.	0,0539 Pf.
2.	„	„	„	350	„	30,78 „	0,0879 „
3.	„	„	„	150	„	18,44 „	0,1229 „
4.	„	Glühlichtlampe	„	16	„	2,37 „	0,1481 „
5.	„	„	„	8	„	1,19 „	0,1488 „
6.	„	Gasflamme	„	12	„	2,13 „	0,1775 „

Bei Berechnung der Kosten der Gasbeleuchtung ist ein Verbrauch von 120 l für die Flamme und Stunde zum Preise von 16 Pfg. für 1 cbm, den örtlichen Verhältnissen entsprechend zu Grunde gelegt.

Es sind hier die Selbstkosten der elektrischen Beleuchtung dem Verkaufspreise des Gases gegenüber gestellt. Letztere Zahl müsste insofern noch eine Berichtigung erfahren, als man dieselbe um den Betrag der Amortisation und Verzinsung der Gasbeleuchtungsanlage im Hause und deren Bedienung vergrössern müsste. Man wird in den meisten Fällen, so unrichtig es auf den ersten Augenblick auch erscheint, wie es hier geschehen, die Selbstkosten der elektrischen Beleuchtung mit dem Verkaufspreise des Gases vergleichen müssen, da z. B. die inmitten der Stadt gelegenen Theater u. s. w.

sich nicht jedes eine besondere Gasanstalt einrichten können, vielmehr darauf angewiesen sind, das Gas von einer grösseren Anstalt zu kaufen. Mag das elektrische Glühlicht immerhin pro Normalkerze und Zeiteinheit theurer kommen, so sind doch die mit seiner Einführung verbundenen Vortheile für viele Zwecke so bedeutende, dass die eventuell etwas höheren Kosten nicht in Frage kommen. C. William Siemens in London äusserte sich, als er vor einer Parlamentscommission vernommen wurde, über die Beleuchtungsfrage im allgemeinen folgendermassen: „Wenn im allgemeinen von den Kosten der Gasbeleuchtung und der elektrischen Beleuchtung die Rede ist, so denke ich, sie werden sich so ziemlich gleich sein. Wenn man zwischen beiden Beleuchtungsarten zu wählen hat, so werden es meist andere Eigenschaften sein als die Kosten, welche entscheiden".

Auch darf man vor allen Dingen nicht vergessen, dass infolge Einführung des elektrischen Lichtes verschiedene andere Ausgaben erheblich kleiner werden. Erstens sinkt die Feuerversicherungsprämie, sodann braucht die Ausstattung des erleuchteten Raumes weniger oft aufgefrischt zu werden; endlich können die Lüftungsvorrichtungen vereinfacht werden. Dagegen werden gewiss die Einnahmen der Theater steigen, da die bisher im Sommer in denselben vorhandene, unerträgliche Hitze nicht mehr vom Besuche abschrecken wird.

Derjenige Umstand, welcher der allgemeinen und baldigen Einführung der elektrischen Beleuchtung, namentlich in den bereits bestehenden Theatern, allein entgegenstehen dürfte, besteht in deren hohen Anlagekosten. Bisher ist es allerdings erforderlich, dass sich jeder Verbraucher elektrischen Lichtes eine eigene Maschinenanlage errichtet; dies wird aber in Berlin

bald nicht mehr nothwendig sein. Ich bin in der Lage, Ihnen von zuverlässiger Seite mittheilen zu können, dass es zu den Aufgaben der neuen Edison Gesellschaft, deren Gründung in kürzester Zeit hier bevorsteht, gehören wird, zunächst kleinere Centralstationen einzurichten, von denen der Strom je nach Bedarf an einzelne Theater, Waarenmagazine u. s. w. abgegeben wird. Hoffen wir also, m. H., dass die Tage nicht mehr fern sind, wo wir uns in unseren Theatern des Vorzuges der elektrischen Beleuchtung erfreuen und nicht mehr im Schweisse unseres Angesichtes Kunst geniessen müssen. Denn wer die elektrischen Theater-Beleuchtungen in London und Brünn gesehen hat, muss zugeben, dass wir uns damit nicht mehr im Zustande des Versuches befinden, sondern dass wir etwas Fertiges und zur allgemeinen Einführung Reifes vor uns haben.

Theater in Havanna auf Kuba.*)

Im Anschluss an den im Märzhefte der Zeitschrift S. 191 veröffentlichten Vortrag über die elektrische Beleuchtung des Savoy-Theaters in London und des Stadttheaters in Brünn geben wir in folgendem nach einer sehr interessanten Mittheilung in „La Lumière électrique" (1883, S. 62) eine Beschreibung der Beleuchtungsanlage eines kleinen Theaters in Havanna auf Kuba, welches bereits seit einem Jahre ununterbrochen nach Edison'schem System elektrisch beleuchtet wird.

Das Theater wurde ursprünglich durch Gas erleuchtet. An die Stelle von 342 Gasbrennern sind 182 Edison'sche B-Glühlampen von 8 und 11 A-Glühlampen von 16 Normalkerzen Lichtstärke getreten. Die geringe Anzahl von Glühlampen im Vergleich zu den Gaslampen ist durch die sehr schlechte Beschaffenheit des Leuchtgases zu erklären.

*) Die folgenden Beschreibungen des Theaters in Kuba, des Bijou-Theaters in Boston und des Théâtre du Parc in Brüssel sind im Junihefte 1883 der Zeitschrift des Vereines deutscher Ingenieure veröffentlicht worden.

Die Vertheilung der Glühlampen im Theater ist folgende:

Rampe	22	B-Lampen
2 Soffitten zu je 10 L.	20	„
2 Soffitten zu je 6 L.	12	„
36 an den drei Gallerien angebrachte Träger zu je 2 L.	72	„
4 Träger zu je 4 L., angebracht an den beiden Seiten der Bühne, nahe den Prosceniumslogen	16	„
24 in den vier Fluren gleichmässig vertheilte L.	24	„
6 L. auf den Fluren vor den Spiegeln	6	„
10 in verschiedenen Logen angebrachte L.	10	„
Summe	182	B-Lampen.
In der Vorhalle	8	A-Lampen
Ueber den Eingängen zu dem Theater	3	„
Summe	11	A-Lampen.
Zur Erleuchtung des Maschinenraumes dienen ferner	20	A-Lampen.

Die Lampen der obersten Gallerie sind mit Reflectoren aus weissem Porzellan ausgerüstet. Die Soffittenlampen sowohl als die Rampenlampen sind mit Reflectoren aus polirtem Eisenbleche versehen. Durch die Anbringung dieser Reflectoren, welche bei den Glühlampen direct über denselben angebracht werden können, wird bewirkt, dass das ganze Licht auf die Bühne geworfen werden kann. Diesem Umstand ist es zuzuschreiben, dass trotz der geringen Anzahl von Glühlampen auf der Bühne diese dennoch hinreichend beleuchtet wird. Es ist eben ein grosser Vorzug der Glühlampen, dass sich ein Reflector unmittelbar über ihnen anbringen lässt. Die Dämpfung der Lampen wird auf einfache und bekannte Weise durch Einschaltung von Widerständen in die Leitungen bewirkt.

Den zur Speisung der Glühlampen erforderlichen Strom liefern zwei Edison'sche Dynamomaschinen, Modell Z, zu deren Betrieb eine 14 pferdige Dampfmaschine dient. Das Maschinenhaus befindet sich 36,5 m vom Theater entfernt. Die beiden Dynamomaschinen arbeiten in getrennten Stromkreisen. Die eine speist die Lampen, welche sich über dem Eingange, in der Vorhalle, in den Logen, in den Fluren und auf der obersten Gallerie des Zuschauerraumes befinden; die andere versorgt die Lampen der beiden unteren Gallerien, der Soffitten, der Rampe und der vier seitlich der Bühne angebrachten Leuchter.

Die getrennte Zuleitung des Stromes und die angegebene Vertheilung der Lampen in den beiden Stromkreisen ist gewählt worden, damit, falls eine der elektrischen Maschinen den Dienst versagen sollte, in keinem Theile des Theaters vollständige Finsterniss herrsche. Obwohl eine Aushülfedampfmaschine nicht vorhanden ist, hat eine Unterbrechung der Beleuchtung bisher nicht stattgefunden. Dies ist umsomehr hervorzuheben, da die ganze Beleuchtungsanlage, welche nur vorläufig eingerichtet wurde, weit entfernt ist, vollkommen zu sein.

Die Beleuchtung ist täglich 5 Stunden im Betriebe, dies macht im Jahre 1825 Brennstunden. Es liefern also die 182 Lampen von 1 Carcel Lichtstärke (1 Carcel ungefähr = 8 Normalkerzen) 332 150 Carcel-Brennstunden, die 31 Lampen von 2 Carcels 113 150, sämmtliche Lampen zusammen also 445 300 Carcel-Brennstunden.

Die Kosten der Anlage, bestehend aus einer Dampfmaschine, einem Kessel, zwei dynamo-elektrischen Maschinen nebst Zubehör, einem kleinen Elektromotor, welcher zum Betrieb einer Nähmaschine dient, ferner den Leitungen, Lampen u. s. w., betrugen 20 000 fr. Es muss jedoch hierzu bemerkt

werden, dass dieselben in Anbetracht der Kleinheit der Anlage verhältnissmässig gross sind, und dass sich dieselben bei einer grossen Anlage unbedingt niedriger stellen würden.

Die täglichen Betriebskosten sind folgende:

200 kg Anthracit-Kohle, 47,5 fr. die Tonne	9,50 fr.
Ein Maschinenwärter	30,00 „
Ein Heizer	12,50 „
Schmieren etwa	2,50 „
täglich zusammen	54,50 fr.

Die jährlichen Unkosten betragen:

Verzinsung und Amortisation mit 20 pCt.	4 000 fr.
Erneuerung der Lampen; dieselben brennen durchschnittlich 800 Stunden und müssen daher ungefähr $2^1/_2$ mal im Jahr erneuert werden. Das macht 533 Lampen; jede kostet 3,50 fr.	1 865 „
Betriebskosten 54,50 fr. × 365	19 892 „
zusammen für 445 300 Carcel-Brennstunden	25 757 fr.
also für 1 Carcel-Brennstunde	0,0578 fr.

Bei Anwendung von Gas kostet die Carcel-Brennstunde . . . 0,0625 „

Der französische Berichterstatter bemerkt, dass die in Rechnung gezogenen Posten für die elektrische Beleuchtungsanlage sehr reichlich bemessen worden sind. Der sehr hohe Gaspreis hat nicht allein seinen Grund in dem hohen Preise der importirten englischen Kohle, sondern namentlich in dem grossen Verlust an Gas in den Leitungsröhren, ein Verlust, welcher mehr als 30 pCt. des fabricirten Gases beträgt. Diese grossen Verluste werden theils durch eine grosse Ablagerung von Ausscheidungsproducten aus dem sehr mangelhaft gereinigten Gase verursacht, theils haben sie ihren Grund in der verschiedenen Ausdehnung der Gasometer und der Röhren über

Tage, welche einer tropischen Sonne und den Röhren unter der Erde, welche einer viel niedrigeren und gleichmässigeren Temperatur ausgesetzt sind.

Eine Unterbrechung der beschriebenen Anlage hat, wie bereits oben erwähnt, bisher nicht stattgefunden; das Edison'sche elektrische Beleuchtungssystem hat sich also auch hier sehr gut bewährt. Eine ganz besondere Annehmlichkeit verschafft die elektrische Beleuchtung in einem tropischen Lande ihrer geringen Wärmeentwicklung wegen dem Publikum und den Schauspielern. Der Unterschied der durch die Gas- und die elektrische Beleuchtung verursachten Temperatur im Theater bei gleicher äusserer Temperatur ist mehrere Male gemessen worden; er betrug nicht weniger als 8° C.!

Das Bijou-Theater in Boston.

Am 12. December v. J. ist in Amerika die erste Theater-Beleuchtung nach Edison'schem System, nämlich die des Bijou-Theaters in Boston, in Betrieb gesetzt worden. Es sind ungefähr 650 Glühlampen im Theater vorhanden. Die Maschinenanlage, welche 160 m weit von dem Theater untergebracht ist, besteht aus einem Dampfkessel von Babcock und Wilcox, einer Dampfmaschine von Lawrence und zwei Edison'schen Dynamomaschinen, Modell *K*. Der Strom wird mittelst Edison-Kabel zum Theater geleitet. Im Erdgeschoss auf der rechten Seite der Bühne befinden sich die Stromeinschalter und die zur Regulirung der Lichtstärke der Lampen dienenden Apparate, von welchen aus die Leitungen durch das ganze Haus vertheilt werden. Es sind drei Regulirungsapparate vorhanden; der eine für den Zuschauerraum, der zweite für die Soffitten-, der dritte für die Prosceniumslampen.

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Die Vertheilung der Lampen im Theater ist folgende. Die Bühne wird erleuchtet durch 192 mit Reflectoren versehene Lampen, welche in drei Reihen an den Portalcoulissen angebracht sind, und durch 140 ebenfalls mit Reflectoren versehene Soffittenlampen. Rampenlampen sind nicht vorhanden. An dem im Zuschauerraume befindlichen sehr schönen Krystall-Kronleuchter sind 60 Lampen angebracht; ausserdem sind noch drei kleinere Kronleuchter mit je 18 Lampen vorhanden. In den Logen und Gallerien brennen 88 Lampen. Die Treppe wird durch 3 Kandelaber mit je 12 Lampen und das Foyer durch 1 Kandelaber mit 6 und durch 2 Kandelaber mit je 3 Lampen erleuchtet. Zur Beleuchtung der Bureaux dienen 4 Kronleuchter mit je 4 Lampen und einer mit 9 Lampen. Endlich befindet sich vor dem Theater ein Kandelaber mit 40 Lampen. Es mag bemerkt werden, dass die Anlage innerhalb zwei Wochen nach dem gegebenen Auftrage ausgeführt worden ist.

Das Théâtre du Parc in Brüssel.

Seit dem 5. März d. J. wird auch das Théâtre du Parc in Brüssel nach Edison's System elektrisch beleuchtet. Dasselbe hat 350 A-Lampen erhalten. Die elektrischen Maschinen, zwei *K*-Maschinen, sind 20 m von dem Theater aufgestellt. Der Zuschauerraum wird durch 66 Lampen, welche an dem vorhandenen Kronleuchter angebracht sind, und durch 26 Lampen, welche sich seitlich von der Bühne befinden, erleuchtet. Die Rampe hat 26 Lampen mit mattem Glas erhalten. An den Lampengestellen zwischen den Soffitten sind je 10 Lampen angebracht. Die Flure des Theaters, die Zimmer der Künstler und der Platz vor dem Theater werden ebenfalls durch Glühlampen erleuchtet.

Beleuchtung des kgl. Residenz-Theaters in München nach Edison's System.*)

Der von uns im Märzhefte der Zeitschrift ausgesprochene Wunsch, möglichst bald auch die deutschen Theater elektrisch beleuchtet zu sehen, scheint schneller, als erwartet, in Erfüllung zu gehen. Bereits am 25. Mai fand die erste Vorstellung im kgl. Residenz-Theater in München bei elektrischer Glühlichtbeleuchtung statt, und errang die neue Beleuchtungsart einen glänzenden Erfolg. Wir wollen hier eine kurze Beschreibung dieser interessanten Anlage geben, ohne näher auf die besonderen Einrichtungen des Edison'schen Beleuchtungssystems für Theaterzwecke einzugehen, da dieselben bereits in dem oben bezeichneten Aufsatze ausführlich besprochen worden sind.

Das kleine, etwa 600 Personen fassende Residenz-Theater, welches seiner reichen, im schönsten Barockstil gehaltenen Ausstattung wegen für die elektrische Glühlichtbeleuchtung sich besonders eignet, wird durch ungefähr 800 Edison-Glühlampen erleuchtet. Den Strom liefern drei Edison'sche Dynamomaschinen, Modell *K*, von denen jede für 250 sechszehnkerzige bezw. 500 achtkerzige Lampen construirt ist. Dieselben arbeiten in einem Stromkreise und sind parallel geschaltet. Als Motoren dienen drei Compound-Dampfmaschinen der Firma Ruston, Proctor & Co. in Lincoln von je 40 Pfdkr., welche in dem zwischen dem Residenz-Theater und dem Hof-

*) Aus der Zeitschrift des Vereins deutscher Ingenieure. Juliheft 1883.

und National-Theater befindlichen Hofe aufgestellt sind. Vermittelst lederner Treibriemen, deren Enden so mit einander verbunden sind, dass jeder Vorsprung vermieden ist, wird die Kraft auf eine gemeinsame Transmissionswelle übertragen, von welcher aus die drei im Kellergeschosse des Theaters stehenden Dynamomaschinen getrieben werden; letztere machen 900 Umdrehungen in der Minute. Der erzeugte Strom wird unweit von den Dynamomaschinen, in ähnlicher Weise wie bei der Brünner Anlage, in zwei Stomkreise getheilt, von denen der eine die sog. Hausleitung, der andere die Leitung für den Bühnen- und Zuschauerraum bildet. Die Vertheilung der Lampen im ganzen Theater ist die folgende:

Hausleitung:			
Treppen, Flure u. s. w. . . .	58	sechszehnkerzige Lampen	
" " . .	6	achtkerzige "	
Ankleidezimmer	24	sechszehnkerzige "	
			88
Bühne:			
7 Soffitten . . . zu je 35 =	245	sechszehnkerzige Lampen	
2 Portalcoulissen " " 10 =	20	" "	
12 Coulissen . . . " " 6 =	72	" "	
6 Versetzstücke " " 12 =	72	" "	
2 " " " 20 =	40	" "	
Rampe	40	" "	
Unterbühne	7	" "	
Schnürboden	10	" "	
			506
Zuschauerraum:			
Kronleuchter	60	sechszehnkerzige Lampen	
Balcon-Beleuchtung	96	achtkerzige "	
			156
Maschinenräume	16	sechszehnkerzige Lampen	16
		Im ganzen	766.

Die sämmtlichen Lampen sind nicht, wie im Zuschauerraume des Brünner Theaters, mit Milchglasglocken umgeben, sondern strahlen vielmehr ihr volles Licht aus, ohne dass dadurch, wie häufig behauptet wird, etwa eine unangenehme Einwirkung auf die Augen bemerkbar würde. Im Gegentheil, gerade im Residenz-Theater konnte man von einem Abend, an dem noch mit Gas beleuchtet wurde, zum anderen, an dem das elektrische Licht brannte, von neuem und überzeugend erkennen, wieviel mal angenehmer das elektrische Glühlicht dem Auge ist als das Gaslicht.

Während bei Gasbeleuchtung die Bühne den Eindruck machte, als sei sie mit dicker, zitternder Luft erfüllt, erschienen bei der elektrischen Beleuchtung alle Personen und Gegenstände dem Auge ausserordentlich klar und nahe gerückt.

Das wesentliche der Einrichtung des auf der linken Seite der Bühne an der Prosceniumswand angebrachten Lichtstärken-Regulirapparates ist bereits im Märzhefte d. Zschft. d. V. d. Ing. S. 200 beschrieben worden. Es möge hier noch angeführt werden, dass im Ganzen 29 Regulirungshebel vorhanden sind, und zwar je 7 für die Coulissen, 7 für die Soffitten, 2 für die beiden Seiten der Rampe, 4 für die Versetzstücke, 1 für den Kronleuchter und 1 für die Balconbeleuchtung. An dem Regulirungsapparate ist ferner eine Vorrichtung angebracht, durch welche es ermöglicht ist, jede Lampengruppe plötzlich aufleuchten zu lassen, d. h. den Blitz nachzuahmen. Auf dem Fussboden der Bühne befinden sich 35 Einschaltstellen, von welchen aus der Strom durch biegsame Leitungen den Versetzstücken zugeführt wird.

Wie aus vorstehender Beschreibung hervorgeht, sind zur Hervorbringung der Farbeneffecte nicht, wie in Brünn, besondere farbige, in getrennten Stromkreisen arbeitende Lampen

vorhanden, vielmehr dient hierzu ein sinnreicher, besonders für diesen Zweck von dem Ober-Maschinenmeister der kgl. Bühnen in München, Hrn. Lautenschläger, construirter „Universalapparat für farbige Beleuchtungseffecte", welcher im wesentlichen aus einer um das Glühlampengestell drehbaren Trommel aus farbiger, über Netzwerk gegossener Gelatine besteht und stehend, liegend oder hängend benutzt werden kann. Ein Urtheil darüber, ob die Vorrichtung im Brünner- oder die im Residenz-Theater am meisten den praktischen Bedürfnissen entspricht, kann, da beide Einrichtungen erst seit kurzer Zeit im Betriebe sind, noch nicht gefällt werden. Da bei der Brünner Einrichtung dreimal so viel Lampen, als zur wirklichen Beleuchtung der Bühne nothwendig, angebracht werden müssen, so vertheuern sich hierdurch die Kosten der Anlage erheblich; auch werden die häufig hin und her zu bewegenden Soffitten- und Coulissen-Lampengestelle verhältnissmässig schwer. Dagegen bietet dieselbe den Vortheil, dass sowohl die Regulirung der Lichtstärken, als auch die der Farbenwirkungen von einer Centralstelle aus für jede beliebige Gruppe von Lampen bewirkt werden kann, während bei der Vorrichtung im Residenz-Theater jede einzelne Trommel mittelst Schnurscheibe und Schnur von Hand gedreht werden muss.

Die Anlage im Residenz-Theater ist von Hrn. Philip Seubel im Auftrage der zur Ausbeutung der Erfindungen von Thomas Alva Edison in Deutschland begründeten Deutschen Edison Gesellschaft, welcher auch die Einrichtung elektrischer Beleuchtung im kgl. Theater in Stuttgart übertragen ist, ausgeführt worden.

Seit dem 28. v. M. wird auch das Manzoni-Theater in Mailand mit Edison-Glühlampen erleuchtet, welche den zu ihrem Betrieb erforderlichen elektrischen Strom von der grossen, daselbst nach dem New-Yorker Muster errichteten Centralstation aus erhalten; letztere soll vorläufig zum Betriebe von 3600 sechszehnkerzigen Glühlampen dienen, deren Zahl man aber auf 10 000 zu erhöhen beabsichtigt.

Zur Vollständigkeit unserer Berichte über elektrische Theaterbeleuchtungen möge noch bemerkt werden, dass der erste Versuch dieser Art in Deutschland auf der Bühne des kgl. Opernhauses in Berlin durch den kgl. Ober-Maschinen-Inspector Hrn. Brandt ausgeführt worden ist. Seit dem 29. Mai 1882 wurden einige Wochen lang allabendlich die beiden ersten Coulissen durch 42 elektrische Glühlampen erleuchtet; dieselben brannten in drei Stromkreisen, von denen der eine die weissen, der zweite die rothen und der dritte die grünen Lampen enthielt. Die Regulirung des Lichtes gelang vollkommen.

Im Anschluss an die vorstehende Beschreibung der Münchener Residenz-Theater-Beleuchtung theilen wir auszugsweise ein Gutachten mit, welches am 13. Juni d. J. von dem Geh. Rathe Dr. Max von Pettenkofer über die Beleuchtung des kgl. Residenz-Theaters in München mit Gas und mit elektrischem Lichte abgegeben wurde und wegen des hohen Ansehens seines Verfassers ein besonderes Interesse beanspruchen dürfte.

Um den Einfluss der Gasbeleuchtung und der elektrischen Beleuchtung auf die Temperatur und den Kohlensäuregehalt der Luft im ganzen Hause kennen zu lernen, wurden die hierzu erforderlichen Versuche gleichzeitig im Parquet, im I. und im III. Range (Gallerie), und zwar sowohl bei leerem Hause, als auch während der Theatervorstellungen ausgeführt. Bei besetztem Hause waren jedesmal zwischen 500 und 600 Personen im Zuschauerraum anwesend; die Thermometer wurden von 10 zu 10 Minuten beobachtet. Die Temperatur stieg so-

wohl bei leerem, als auch bei besetztem Hause vom tiefsten Stand am Anfang mit ganz unbedeutenden Schwankungen ununterbrochen bis zum höchsten Stand am Ende. Die Ergebnisse dieser Versuche haben zweifellos bewiesen, wie verhältnissmässig wenig die Luft durch die elektrische, im Gegensatze zur Gasbeleuchtung, erhitzt wird. So war z. B. bei leerem Hause die Temperaturerhöhung im obersten Range bei Gasbeleuchtung 10 mal (9,2 zu 0,9) grösser als bei elektrischer Beleuchtung; die Temperaturunterschiede in den unteren Räumen des Theaters waren natürlich geringer. Bei besetztem Hause betrug bei elektrischer Beleuchtung sogar die Temperatur auf der Gallerie (23° C.) annähernd nicht mehr, als bei der Gasbeleuchtung im Parquet (22,2° C.).

Endlich muss noch hervorgehoben werden, dass bei Anstellung der Versuche mit der Gasbeleuchtung die Aussentemperatur niedriger war, als bei den Versuchen mit elektrischer Beleuchtung, so dass also letztere jedenfalls nicht im Vortheil war.

Der höchste beobachtete Kohlensäuregehalt betrug bei besetztem Hause:

bei Gasbeleuchtung	2,3	auf Tausend
bei elektrischer Beleuchtung .	1,8	„ „

Der Unterschied ist geringer, als man erwarten sollte, da doch bei der Benutzung von Edison'schen Glühlampen eine Kohlensäureentwicklung nicht stattfindet, die Zunahme an Kohlensäure also in diesem Fall ausschliesslich von den im Theater befindlichen Menschen herrührt. Es muss jedoch besonders hervorgehoben werden, dass bei der elektrischen Beleuchtung die besonders schädlichen Producte der unvollständigen Verbrennung des Leuchtgases, wie Kohlenoxyd, Kohlenwasserstoff und Schwefelwasserstoff überhaupt nicht in die Luft gelangen. Uebrigens legt Prof. von Pettenkofer den Kohlensäurebeobachtungen einen besonderen Werth nicht bei und ist vielmehr der Ansicht, dass dieselben öfter und besonders an mehreren Punkten des Theaters ausgeführt werden müssten, um ein sicheres Resultat zu erhalten.

Auf Grund seiner Untersuchungen zieht Prof. von Pettenkofer die folgenden Schlüsse:

1. dass die elektrische Beleuchtung im hohen Grade die Ueberhitzung der Luft im Theater verhindere;

2. dass sie allerdings an und für sich nicht im Stande sei, die Lüftung des Theaters entbehrlich zu machen, dass sie aber eine geringere Lüftung desselben erfordere als die Gasbeleuchtung, bei welcher die Lüftung nicht nur gegen die Luftverderbniss durch Menschen, sondern auch gegen die Hitze und die Verbrennungsproducte der Flamme gerichtet werden müsse, während sie es bei elektrischer Beleuchtung nur mit dem Athem und den Hautausdünstungen der Menschen und deren Folgen zu thun habe.

Beleuchtungs-Anlage des Residenztheaters in Stuttgart.

Das Stuttgarter Residenztheater ist bei seinem im Laufe des Sommers 1883 stattgehabten Umbaue gleichfalls mit elektrischer Beleuchtung nach Edison's System versehen worden.

Der bauliche Theil*) der ganzen Anlage zerfällt in das Kesselhaus mit dem Kamin und das Maschinenhaus, zwei einstöckige massive, mit schmiedeeisernen Dachstühlen überdeckte Gebäude von je 260 qm Grundfläche, welche hinter dem Theatergebäude errichtet sind. Im Kesselhause befinden sich 4 neben einander eingemauerte Dampfkessel (Patent G. Kuhn in Berg) mit rauchverzehrenden Feuerungen (System Tenbrink). Jeder Kessel besteht aus einem Oberkessel von 1,10 m Durchmesser und 6,02 m Länge, 2 darunter liegenden Vorwärmern von je 0,63 m Durchmesser und 5,39 m Länge, einem grösseren und einem kleineren Quersieder. Die gesammte Heizfläche jedes dieser Kessel berechnet sich auf 33 qm, und da für den regelrechten Betrieb der Dampfmaschinen und der Centraldampfheizungsanlage 3 Kessel ausreichen, so verbleibt der 4. Kessel für die Aushilfe. Die mit allen erforderlichen Heiz- und Sicherheitsarmaturen ausgerüsteten Kessel werden durch eine Dampfpumpe, sowie durch eine zweite Speisevorrichtung, bestehend in einem Injector, aus der Neckarwasserleitung gespeist. Die Kessel sind auf 8 Atm. Ueberdruck concessionirt. Der den 4 Dampfkesseln gemeinsame Kamin ist 35,5 m hoch und in das Innere des Theatergebäudes verlegt.

*) Auszug aus einem in No. 4 1884 der Zeitschrift des Vereines Deutscher Ingenieure veröffentlichten Artikel.

In dem Maschinenhause befinden sich, ebenfalls von G. Kuhn geliefert, 2 Compounddampfmaschinen mit Condensation und von je 60 bis 100 Pferdekraft bei 130 Umdrehungen, 4 dynamoelektrische Edison'sche Maschinen (Modell K), jede für 250 Glühlampen von 16 Normalkerzen, eine kleine dynamoelektrische Maschine (Modell E) mit besonderem Motor (Dreicylindermaschine, 400 Umdrehungen) für die Nothbeleuchtung am Abend und für die Tagesproben auf der Bühne; ferner der Stromregulirapparat und die Transmissionsanlage, welche die Maschinen mit einander verbindet; ausserdem sind noch die Fundamente für eine dritte Compounddampfmaschine und 2 weitere Edison-Maschinen von gleicher Grösse wie die obigen für die etwa einzurichtende elektrische Beleuchtung des kgl. Residenzschlosses vorgesehen. Die Dampfmaschinen mit Meyer'scher Expansionssteuerung, welche mittelst Knüttel'scher Regulatoren bethätigt werden, zeichnen sich bei der sehr hohen Umdrehungszahl (130) durch ruhigen Gang aus; sie sind solid construirt und so angelegt, dass bei eintretender Reparaturbedürftigkeit einer der beiden Maschinen die andere zum Betriebe der Gesammtanlage herangezogen werden kann. Die Schwungräder sind als Riemenscheiben ausgeführt und übertragen die gesammte Kraft der Maschinen auf die in einfacher Weise am Boden angeordnete Transmissionswelle mittelst Lederriemen und Reibungskupplungen (Patent Dohmen-Leblanc). Direct von der Transmissionswelle, welche mit 300 Umdrehungen in der Minute läuft, werden gleichfalls mittelst Lederriemen die 4 neben einander aufgestellten Edison'schen dynamo-elektrischen Maschinen, deren Armaturen mit mehr als 900 Umdrehungen umlaufen, in Bewegung gesetzt; mittelst Klauenkupplung auf der Zwischenwelle lassen sich diese Dynamomaschinen während des Betriebes ausrücken.

Die vier Edison-Maschinen sind durch Parallelschaltung

mit dem einen Hauptkabel verbunden und von diesem unter der Bühne zwei Hauptzweige abgeleitet, von denen der eine zum Bühnenregulator führt und der andere die Hausleitung bildet, welche letztere wiederum in drei Stromkreise getheilt ist. Die Elektromagnete der vier Dynamomaschinen sind unter sich durch Parallelschaltung verbunden, und wird deren Stromzuführung durch einen Hauptregulator im Maschinenhause verstärkt oder geschwächt und dadurch die Gesammtlichtstärke im ganzen Gebäude geregelt. Ein Voltmeter dient zur Beobachtung der Spannung und ein optischer Signalapparat zeigt durch jeweiliges Entzünden einer rothen bezw. einer grünen Lampe an, ob die Spannung über bezw. unter die Normalhöhe gekommen ist. Bei normaler Spannung brennt keine dieser beiden Lampen.

Der Bühnenregulator ist auf der rechten Prosceniumsseite angeordnet und über demselben der dazu gehörige Rheostat. Der Regulator enthält 32 Regulirhebel, durch welche die auf der Bühne und im Zuschauerraume vertheilten Lampen hell oder dunkel gestellt werden können. Dies wird bewirkt, indem durch einfache Drehung der Hebel, einzeln oder gruppenweise, die entsprechenden Widerstände in die betreffenden Stromkreise allmählich eingeschaltet werden. Auf der Bühne befinden sich 30 Stromkreise, welche folgendermaassen vertheilt sind: rechte und linke Rampen-, 8 Sofitten-, 16 Coulissen-, rechte und linke Versatz- und schliesslich rechte und linke Transparentbeleuchtung. Letztere 4 Objecte besitzen auf 36 Stellen im Bühnenpodium Einschaltestellen, durch welche transportable Beleuchtungskörper zur Effectbeleuchtung jederzeit leicht eingeschaltet werden können.

Die Beleuchtung des Zuschauerraums ist in 2 Stromkreise getheilt: Kronleuchter und Balkonbeleuchtung; letztere kann auch wieder in drei einzelne Stromkreise getrennt werden.

Der Bühnenregulator gestattet, wie oben schon bemerkt, die Beleuchtung von der grössten Helligkeit bis zu vollständiger Dunkelheit in allen Schattirungen überzuführen, und auf der Bühne lässt sich das Licht durch Vorschieben farbiger Gelatineschirme mittelst eines besonderen Mechanismus je nach Bedürfniss gelb, roth oder grün färben. Am Regulator ist ferner eine Vorrichtung angebracht, durch welche Blitze oder Wetterleuchten nachgeahmt werden können. Dies geschieht durch Bewegung eines eigenen Hebels, durch welchen die im Stromkreise befindlichen Widerstände auf einen Augenblick kurz geschaltet werden, infolge dessen die Lampen hell aufleuchten. Die Beleuchtung des Zuschauerraumes geschieht in der Regel durch den Kronleuchter mit 170 Stück 16-Kerzenlampen. Bei festlicher Beleuchtung treten die drei Balkonreihen mit zusammen 159 10-kerzigen Lampen hinzu. Wenn sämmtliche Lampen brennen, so erscheint das Haus in überreichlich hellem, schönem Lichte. Wie nun aber heutzutage schon die Ansprüche an Beleuchtung überhaupt gestiegen sind, so dürfte es sich wohl empfehlen, für gewöhnlich zu dem Kronleuchter noch in der ersten Balkonreihe mindestens je eine 16-Kerzenlampe an jedem Arme anzubringen und zu entzünden. Dadurch würde ohne wesentliche Mehrkosten der untere Theil des Zuschauerraumes mit dem oberen übereinstimmend und ausgiebig erhellt sein, bei festlichen Veranlassungen aber eine genügend auffällige Zahl von Lampen mehr entzündet werden können.

Die Ankleidezimmer des Theaterpersonals sind ebenfalls mit Glühlampen erleuchtet, welch letztere auf Gelenkarmen aufgesetzt sind. Gänge, Treppen, Garderoben u. dergl. sind mit Wand- und Deckenleuchtern versehen, welche, wie früher bemerkt, von den drei Hauptzuführungen im Mittelbaue und den beiden Seiten gespeist werden. Jede Abzweigung von den Hauptleitungen geschieht durch Edison'sche Bleischaltungen, so dass ein Ueberhitzen irgend einer fehlerhaften Leitung niemals eintreten kann.

Die Vertheilung der Glühlampen im Theater ist folgende:

	10	16	32 kerzige Glühlampen	
Bühne	18	158	156	
Zuschauerraum	159	209		
Treppen, Corridore, Verwaltungsgebäude Strassenlaternen, Garderoben etc.		272		
Ankleidezimmer und Balletsaal		57		
Maschinenhaus		15		
Nothbeleuchtung	33			
	210	711	156	in Summa 1077

Durch die eingangs angeführte Dreicylindermaschine wird eine kleinere Edisonmaschine und dadurch eine Anzahl von Lampen in ganz getrenntem Stromkreise in Betrieb gehalten, welch letztere derart im ganzen Theater vertheilt sind, dass bei Ausserbetriebsetzung der Hauptbeleuchtung noch hinreichend Licht vorhanden ist, um sich auf Gängen und Treppen zurecht zu finden. Diese Nothbeleuchtung (33 Lampen) dient zugleich bei Tage für die Bühnenarbeiten und die Proben.

Beim Haupteingange, bei der Kasse und auf den Haupttreppen sind die drei Hauptzweige der Hausbeleuchtung in der Weise angelegt, dass abwechselnd die Beleuchtung immer aus einem anderen Stromkreise entnommen wird, so dass bei etwaigem Versagen eines Hauptstranges immer noch Strom von mindestens einer der beiden anderen Leitungen zugeführt wird, diese Stellen also niemals vollständig in Dunkel gerathen können.

Wir wollen obigem Berichte noch hinzufügen, dass die beschriebene Anlage seit dem 16 November v. J. sich in ununterbrochenem Betriebe befindet und allen gehegten Erwartungen in vollstem Masse entsprochen hat.

Zur Vervollständigung unserer Mittheilungen über die Theaterbeleuchtungen möge noch erwähnt werden, dass auch im Königl. Hoftheater in Dresden bereits seit geraumer Zeit unter Leitung des Herrn Inspektors B. Bähr Versuche mit Edison's Glühlichtbeleuchtung gemacht werden. Und zwar kommt hierbei eine Dynamomaschine, Modell L., für 150 Sechzehnkerzen-Lampen in Anwendung, welche 70 Achtkerzen-Lampen an der Fussrampe und ca. 70 Sechszehnkerzen-Lampen in den Corridoren und Treppen des Zuschauerraums speist; letztere sind an Stelle der vorhandenen Nothbeleuchtung angebracht worden.

Wenngleich sich schon aus den vorstehenden Schilderungen die unbestreitbare Brauchbarkeit und hohe Wichtigkeit der elektrischen Glühlichtbeleuchtung für Theaterzwecke ergiebt, so kann doch als bester Beweis hierfür die Thatsache gelten, dass die Kgl. Hoftheater-Intendanz in München — nachdem sie sieben Monate lang die Glühlichtbeleuchtung im Residenz-Theater erprobte — nunmehr der Deutschen Edison Gesellschaft auch die Beleuchtung des Kgl. Hof- und Nationaltheaters übertragen hat.

DIE ANLAGEN ZUR ELEKTRISCHEN BELEUCHTUNG DES STADTTHEATERS IN BRÜNN.

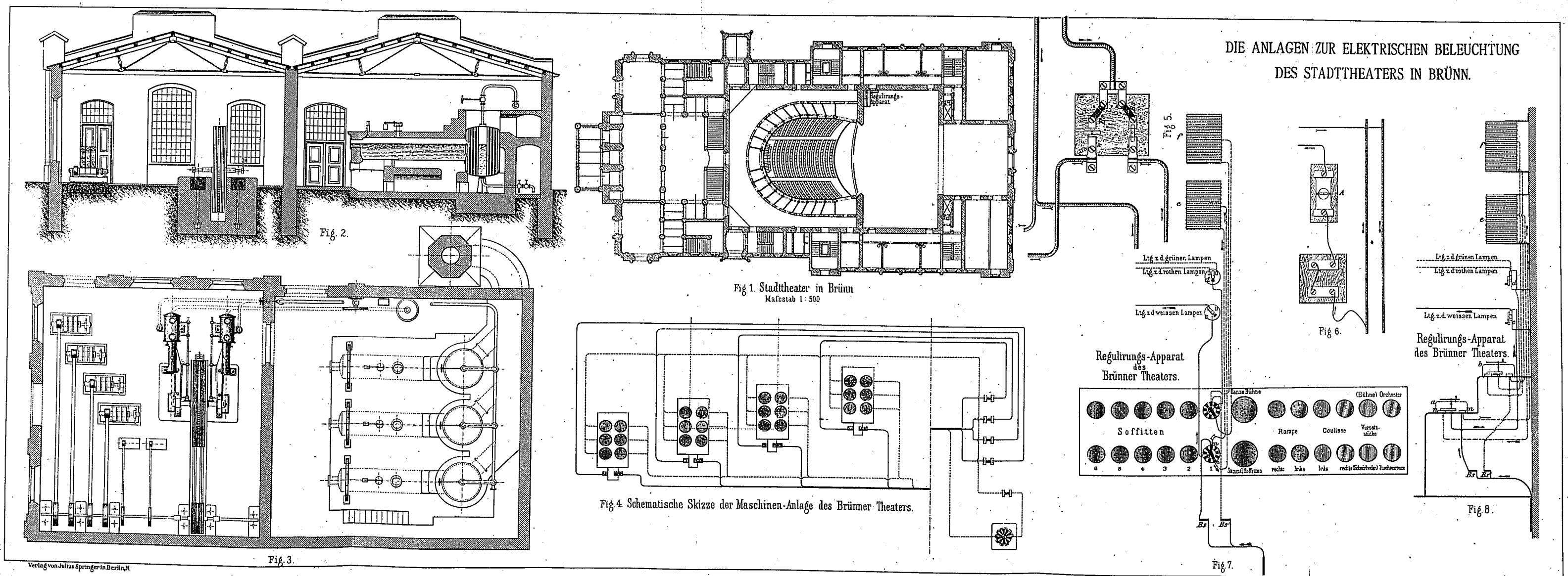

Fig. 2.

Fig. 3.

Fig 1. Stadttheater in Brünn
Maßstab 1 : 500

Fig 4. Schematische Skizze der Maschinen-Anlage des Brünner Theaters.

Fig 5.

Fig 6.

Fig 7.

Fig 8.

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DEUTSCHE
EDISON GESELLSCHAFT

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(Volleingezahltes Capital: 5,000,000 Mark)

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Einrichtung
von Centralstellen zur Lieferung von elektrischem Licht.

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Compania Electrica de Edison

This folder contains printed material issued by the Compania Electrica de Edison. This company marketed the Edison system of electric lighting and other inventions in Chile, Peru, and Bolivia under the direction of Edison's agent, Willis N. Stewart. Company offices were located in Valparaiso, Chile.

The following items have been filmed:

1. "El Almacenamiento de la Electricidad por Medio de Baterias Secundarias -- Opinion de Tomas A. Edison" (1884)
2. "Luz Electrica de Edison" (1885)

EL ALMACENAMIENTO

DE LA

ELECTRICIDAD

POR MEDIO DE

BATERÍAS SECUNDARIAS

Opinion de Tomas A. Edison

Publicacion hecha por la Oficina de la *Luz Eléctrica de Edison* en Chile.

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1884

ADVERTENCIA

La idea de poder almacenar la electricidad no es nueva, i siempre ha seducido a los profanos i a los hombres de la ciencia.

Bajo el amparo de ella no ha muchos años, en Europa i en los Estados Unidos de Norte América, especuladores de mala lei abusando de la credulidad de grandes capitalistas, han acarreado el desprestijio sobre el alumbrado eléctrico, con el fracaso de empresas que tenian por base la errónea aplicacion industrial de un principio científico que en sí es verdadero.

La clara i sencilla esplicacion dada por el señor Edison, a este respecto, i que trascribimos a continuacion, no dudamos que producirá en Chile el mismo efecto que en Norte América i en Europa: la ruina de esas falaces i engañosas especulaciones.

OPINION DEL SEÑOR EDISON

SOBRE EL

Almacenamiento de la Electricidad.

Tomamos del *Boletin XVII* de nuestra Compañía la siguiente entrevista con el señor Edison que orijinalmente fué publicada en el "*Herald*" de Boston. Habló de las baterías de almacenamiento en los términos siguientes:

—"¿Cuál es su opinion, señor Edison, dice el "escritor", sobre la utilidad i valor del almacenamiento eléctrico?"

—"En mi opinion las baterías para almacenar la electricidad son un engaña-bobos, una especie para producir sensacion, un mecanismo de estafa hecho por compañías por acciones."

—"¿Querria usted que repitiese esas espresiones por la prensa?"

—"Por cierto que sí, puesto que es la verdad. El almacenamiento de la electricidad es una de aquellas cosas que seducen la imajinacion; i ninguna cosa mas perfecta que tal idea puede haber sido deseada por los estafadores por ac-

ciones. En 1879 me ocupé de la cuestion, e injenié un sistema para colocar baterías de almacenaje en las casas, unidas a conductores matrices para cargarlas durante el dia i descargarlas en la tarde i noche para el servicio de lámparas de incandescencia. Obtuvo privilejio en el mismo año (olvido la fecha de la patente); pero en ello no hai nada de positivo. Esperimenté bajo todos aspectos. Mis placas fueron preparadas como las de las baterías de Planté. El método para prepararlas i cargarlas es mas engorroso; pero es mejor que el de Faure, una vez preparadas.

"Como usted sabe la primera batería de Faure fué enviada por éste a Sir William Thomson, quien a primera vista quedó maravillado de ella. Se le pidió que la patrocinase i consintió i aceptó un honorario; pero despues de una investigacion se convenció de que en el asunto en cuestion no habia nada, i devolió el honorario a la compañía francesa. El hecho es que cuanto mas investigó tanto mas encontró el vacío de todo el negocio.

"Por medio de lo que Labouchére llama una trampa, esta batería secundaria ha sido usada en Inglaterra por compañías de arco voltaico.

Una sola de estas compañías sirviéndose como punto de apoyo de un acumulador i de una lámpara incandescente, copiado de la mia por un

tal Lane-Fox, puso en aujo a otras compañías subsidiarias cuyo capital en conjunto sobrepujó de *treinta millones de pesos*; i se pagaron por estas compañías inmensas cantidades a la compañía primitiva por sus derechos. Pocos meses ha hizo esplosion la bola de jabon; las acciones que fueron pagadas a 25 pesos se ofrecen por 1 peso, i las compañías estafadoras han sido perseguidas judicialmente por falsificacion en sus prospectos, con relacion al valor del acumulador i al derecho de la lámpara incandescente del señor Fox; pues aparece en los procedimientos seguidos ante el juez Chitty que otra compañía tiene el derecho de la lámpara i esta compañía ha confesado que era un robo de la lámpara de Edison i pagaba derecho (royalty) a la compañía de Edison por su empleo. La demanda ante el juez Chitty fué interpuesta por un tenedor de acciones de una compañía subsidiaria, exijiendo la devolucion de su cuota, fundándose en el motivo arriba espresado. Se dió sentencia a su favor.

—"Pero, no se puede acaso almacenar la electricidad?"

—"Sí. Científicamente el asunto está bien; pero comercialmente es un fracazo tan absoluto como uno pueda imajinarse. Puede usted almacenarla i asegurarla; pero se pierde gradualmente i se escapa con el tiempo. La eficacia de las baterías una vez que se las ha cargado repeti-

das veces comienza a declinar i su capacidad i enerjia disminuyen despues de cierto tiempo de uso, requiriendo mayor número de baterías para sostener una produccion constante. Por efecto de la corrosion de las placas sustentadoras de la batería; por el efecto de la accion local i por otras causas demasiado numerosas para especificar, la depreciacion anual de la batería no baja de 30 por ciento de su costo si se usa diariamente.

"El hecho es que hai dos o tres compañías que han organizado en los Estados Unidos, de poco tiempo a esta parte, compañías subsidiarias de arco voltaico. En este negocio la compañía primitiva ha hecho dinero vendiendo maquinaria, etc., a las compañías industriales; pero éstas no han hecho negocio i casi han cesado de hacer nuevos pedidos. Ahora bien, estas compañías primitivas al ver que la demanda de maquinaria aflojaba han entrado en el negocio de las famosas baterías secundarias. Ahora hacen esta esposicion, que es la mayor habilidad que jamas haya yo oido: "caballeros, ustedes tienen una gran inversion en maquinarias para suministrar luz; pero no sacan plata ustedes de todo esto. Bueno, nosotros tenemos algo con lo cual ustedes pueden utilizar su maquinaria. Ustedes pueden trabajar noche i dia, i trabajar mucho mas. Ustedes pueden utilizar sus instalaciones eléctricas actuales durante el dia i asimismo la

electricidad desarrollada en el dia para luz incandescente, i en la noche ustedes tienen sus instalaciones para luz de arco voltaico directamente". Esto suena bien i parece bueno i sano ¿no es así?" El consejo de directores discute la oferta i resuelven que es una gran cosa. Entónces concluyen que deben entrar en el negocio.

"Voi a decir a usted en dónde está el engaño de este plan. Consiste en el hecho de que el costo de las baterías que deben almacenar esta electricidad *extra*, que debe jenerarse en el dia, seria dos veces mayor que la de la estacion que la produce; de manera que, si la compañía ha invertido ya 100,000 pesos, i conviene en utilizar su maquinaria durante el dia con la adicion de baterías de almacenaje, encontrará que para llevar adelante su propósito tendrá que invertir 200,000 pesos en baterías. Yo garantizo que no habrá un solo consejo directivo entre ciento que se percibirá de ello; i la compañía primitiva no se lo ha de decir hasta que hayan comprado.

"Ahora bien, han comprado las baterías de almacenaje; por supuesto al precio de 200 mil pesos. Sobre esta inversion al fin del primer año tienen una depreciacion de 30%. Para salvarse tienen que castigar intereses en su inversion. Tienen tambien que castigar lo bastante para hacer frente a la otra depreciacion de su instalacion por el tiempo que funciona durante el dia, i tendrán que gastar doble cantidad de

carbon para obtener la misma produccion de sus baterías; por la razon que éstas se interponen entre el jenerador de enerjía i la luz; cosa en la cual hai una pérdida tanto al tiempo de cargar como al descargar, i que hai otra pérdida durante su permanencia, pérdida que aumenta a medida que la batería envejece, despues de haber llegado a cierto máximo.

—¿"Cuál es el máximun de almacenamiento que puede obtenerse con una batería secundaria?

—"Próximamente es de un 50%. Obtiénese el máximun de corriente cuando se utiliza la total capacidad de la batería, de la misma manera que, en una máquina de vapor, en la cual si se hace que el vapor obre sin espansion, se se pierde un 50% del vapor, aunque así se obtenga el máximun de su enerjía; pero este es tambien el mínimun de economía. Por lo tanto, para proceder economicamente, los constructores de motores de vapor solo procuran aprovechar un tercio o un cuarto de la máxima enerjia de ellos; porque, aunque así se hace mas costosa la construccion de las máquinas, no obstante la economía que se obtiene trabajando con espansion compensa los mayores capitales invertidos en ellas.

Cuando dicen que obtienen un 90% de la batería, dicen algo que cientificamente es verdadero. Así, ellos aseguran que cada caballo

de enerjía de corriente de una batería alimenta diez luces de 16 velas cada una. Ahora bien, eso es cierto i no es cierto. Con un caballo de corriente eléctrica obtenido por medio de una batería deben obtenerse 10 luces de 16 velas; pero para conseguirlo forzoso es impedir todas las pérdidas que se efectúan a traves de la batería, a traves de los conductores, a traves del dynamo i otras. Se parte con el poder de un caballo que indica el motor. Cierta cantidad de éste se pierde para mover la maquinaria i el dynamo i todavía cierta otra cantidad se pierde en el dynamo para convertir fuerza en electricidad; i esto porque ninguna máquina es perfecta; ademas, cierta cantidad debe perderse en el conductor que reune la estacion con la batería secundaria; aun otra cantidad se pierde en cargar la batería, por causa de su resistencia e imperfeccion de mecanismo; aun otra cantidad se desperdicia en el intervalo entre la carga i su uso; todavía otra parte tiene que perderse al descargar la batería para el servicio de las lámparas, i como sino fuera bastante, otra parte se perderá en el alambre que conecta la batería a la lámpara. Así que, aquel caballo de fuerza, tiene que desvanecerse hasta que solo suministre el servicio de tres lámparas proximamente; miéntras que si se trabajase directamente se obtendria probablemente hasta seis lámparas.

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—"Ud les pega fuerte a los partidarios de las baterías."

—"La razon por la cual soi duro con esta jente es porque yo tengo una cosa lejítima, i a causa de las operaciones de estos señores hai una pérdida de la confianza pública. Nunca hasta el presente hemos pedido sus dineros al público. Ahora bien, yo no quiero que se abuse de él, por cuanto deseo que nuestra Compañía haga su negocio de luz eléctrica de una manera lejítima, dando un valor cierto por lo que la Compañía recibe; i si ésta vende derechos pruebe a los compradores su valor por medio de resultados obtenidos en la práctica en una ámplia escala comercial, tal cual hacemos a la fecha; de modo que el poner en evidencia estas cosas ha de hacer mas fácil i mejor el éxito de mi sistema i el reconocimiento de sus méritos.

"El mismo engaño que se pretende perpretrar en los Estados Unidos ha sido planteado en Inglaterra, i en úlimo resultado el público ha perdido toda confianza en la luz eléctrica. Esta misma jente se encuentra establecida aquí. Presentan lo que llaman la lámpara de Swan que es una evidente violacion del derecho de la mia. Les hemos demandado en Inglaterra i los demandaremos en este pais. Pero, esta jente sabe perfectamente que se necesita algun tiempo para resolver una demanda i durante este tiem-

po ellos habrán permitido al público invertir fuertes sumas."

—¿Entónces considera Ud. que las baterías de almacenaje son del todo impracticables? ¿No habrá esperanza de que puedan realizar un lejítimo trabajo?

—"No hai esperanza alguna. Esceptuado un número de casos mui limitados, puede considerarse el almacenamiento de la electricidad como enteramente análogo al almacenamiento del gas. Uno de los principales gastos de instalacion de una compañía de gas es el de la cañería. El diámetro medio de sus cañones matrices es de 5 a 6 pulgadas. Pero, si se procediese bajo el principio de tener en cada casa un pequeño gasómetro se podrian servir de una cañeria de una pulgada bajo presion mayor que la que actualmente emplean para forzar el gas a traves de los cañones matrices. La diferencia que economizaria la compañía de gas con este arreglo seria de 15 pesos próximamente de casa á casa, distantes 25 a 30 piés. Pero, el gasómetro de cada casa costaria mucho mas que los 25 piés de cañon matriz que quedan enterrados en la calle. Por otra parte, los gasómetros no serian quizás lo mas conveniente en manos del público; podria haber esplosiones, algunos no tendrian lugar para colocarlos, el gasómetro requeriria cierto mecanismo i manipu-

lacion para reducir la presion al límite que se necesita; mecanismos que tienen un uso incierto.

"El conocimiento del público al tratarse de "mecanismos" es ademas i jeneralmente incierto; i probablemente estas causas han impedido a los injenieros de gas el introducir un sistema de almacenamiento local.

"La compañía eléctrica de arco voltaico que trate de introducir un sistema de almacenaje se propone realizar exactamente la idea arriba espresada. En vez de emplear anchos conductores i electricidad a baja presion, como lo hago yo, intentan economizar en el capital de instalacion usando delgados conductores i electricidad a alta presion; i para hacer que esta electricidad sea utilizable reducen su presion mediante una batería de almacenaje, de la misma manera que el gas a alta presion puede ser almacenado en un gasómetro. Su presion redúcenla hasta hacerla utilizable. Resulta en primer lugar que la corriente de alta presion es mui peligrosa para las vidas. La despreciacion de las baterías de almacenaje, en un sistema de distribucion jeneral, por si sola pagará el interes sobre la mayor cantidad de cobre que se requiere para prescindir del uso de aquellas. Ademas, si estos pequeños conductores de corrientes de alta presion fueran colocados bajo tierra, como deben hacerlo todos los sistemas, para ser industrialmente duraderos en las grandes ciuda-

des, resultaria que el mayor costo, proviniente del aislamiento necesario para impedir la filtracion o escape a tan alta presion, deberia pagar con exceso la mayor cantidad de cobre que se destina en un sistema que emplea corrientes de baja presion, i que no requieren un aislamiento ni tan grande ni tan costoso. El valor de nuestros conductores matrices eléctricos es de 15 pesos mas o ménos de casa a casa. Estos conductores están colocados dos piés bajo el suelo, donde la parte intelijente del público no puede alcanzarlos bajo el pretesto de mejorarlos; miéntras que con baterías de almacenamiento deben invertirse de 75 a 200 pesos en baterías, en cada casa, con el propósito de realizar una economía de 9 pesos de cobre, i para interponer una invencion incierta en qué con seguridad tiene que perderse el 50% del precio de costo.

—"Aquí el señor Edison se detuvo un momento, se quedó pensando, i alzando de repente la cabeza dijo con su especial manera, "tan pronto como un individuo se pone a trabajar en el negocio de baterias secundarias, al punto surje en él su capacidad latente para mentir.".

—"Pero, supongamos que tuviéramos un motor barato tal como el agua ¿no seria económico almacenar la electricidad aun a trueque de gran pérdida de fuerza?

—"Haciendo uso del agua como fuerza mo-

triz, aunque el costo del agua fuera casi nada, todavia habria que considerar el costo de la instalacion para almacenar la electricidad, a lo cual deberia agregarse los intereses i la depreciacion. ¿Dónde está la economía entonces, cuando en la mayor parte de los casos con solo unir el namo directamente a la turbina se puede obtedyner el mismo resultado i mucho mas barato? Pero es necesario tambien tener presente que los motores de agua no son tan económicos como se cree. Rara vez los que se sirven de ellos disponen de un excedente de agua durante todo el año para utilizarlo en este sentido.

"Los individuos que hablan del almacenamiento de la electricidad dicen que las lámparas arden mejor, alimentadas por una batería que por un dynamo. No es así. Las lámparas se mantienen mui brillantes al empezar; pero si de tiempo en tiempo no se las alimenta con nuevas baterías, su poder luminoso decrece rápidamente. Si se tiene una batería que pueda alimentar diez luces, i se desea mantenerlas en actividad hasta las 10 de la noche por ejemplo, será necesario disponer de otras baterías para reforzarla; de otra manera las lámparas disminuirán en poder luminoso ántes de que espire su tiempo indicado. I, entónces despues de apagar las luces, las baterías perderán próximamente un quinto de su carga remanente, ántes de que se las vuelva a cargar.

"Hai en esto una lei natural en contradicion con las baterías de almacenamiento, i consiste en que, cuando el plomo está mui dividido descompone el agua. Es sabido que cuando sir Williams Thomson notó este fenómeno sacó de una batería una verdadera esponja metálica. Todos los metales son un verdadero combustible i cuando se oxidan se trasforman en cenizas; i la operacion de volverle su forma metálica primitiva despues de haber pasado por esta trasformacion requiere el gasto de una enerjía considerable. El señor Brush puede decir que tiene un misto secreto. La verdad del caso es que se sirve de una sal de plomo. Emplean plomo i sus baterías no son sinó baterías de Faure lisa i llanamente. Los constructores de las baterías Brush dicen que necesitan seis meses para fabricarlas. Hai factorías en Nueva York que podrian suministrar en solo tres semanas 6,000 elementos de ese sistema! La primitiva compañía de Brush, es una asociacion respetable i con responsabilidad; pero la compañía de almacenamiento de electricidad Brush i Swan tiene todos los visos de ser una corporacion que busca a escudar sus engaños bajo el patrocinio de la primitiva compañía Brush."

—"En este momento el señor Edison tomó un diario i leyó algunos estractos de un artículo referente a la compañía de luz eléctrica de Brush i Swan. Comentándolo dijo, entre otras

tosas: "Creo que existe una sociedad para impedir la crueldad para con los animales, i otra para impedir la crueldad para con los niños. Actualmente deberian fundar otra para impedir que las jentes se engañasen a sí mismos."

El hecho de recibir dinero por tales artículos (refiriéndose al que leia) debia ser considerado como una ofensa a la lei; porque si esto no es obtener dinero con falsos pretestos yo no sé lo que es."

"Volvamos a las baterias de almacenamiento i comparemos su costo i los resultados con los de un sistema directo. Conforme a los recientes esperimentos efectuados en Paris por el señor Tresca en el Conservatorio de Artes i Oficios, con una batería de Faure, se ha encontrado en las mejores condiciones, que dicha batería solo produce el cincuenta por ciento de la enerjia del dynamo i el cuarenta i cinco por ciento de la del motor. Esta batería que alimentaba once lámparas durante once horas, tenia un peso de 2,310 libras. Ciento noventa libras de batería corresponden pues a diez lámparas por hora. Si esta batería se puede vender a 35 centavos libra, el costo por batería correspondiente a diez lámparas por hora será $ 66,50 centavos o $ 6,65 centavos para una lámpara por hora. Para 250, luces por una hora, el costo de batería es por lo tanto de $ 1662 50 centavos i para seis horas $ 9,975. Por consiguiente, una

batería que puede alimentar 250 lámparas durante seis horas importa $ 9,975."

"Depreciacion, 25 %	$ 2493 75
Intereses, 8 %	
Como, segun los resultados, se obtiene diez lámparas por cada caballo motor en las baterías secundarias, desarrollarán 25 caballos; pero, como sólo el 50 por ciento de la enerjia desarrollada por el motor es devuelta por la batería, se necesitaron para cargarla evidentemente 37,5 caballos durante las 8 horas. El motor habrá desarrollado 350 caballos a razon de 4 libras de carbon por cada caballo. Un total de 1,200 libras por dia, o de 180 toneladas anualmente, contando 300 dias, a 4 pesos 50 centavos por tonelada hacen.............	810 00
Por intereses i depreciacion, sobre $ 3,000, costo del dynamo empleado en cargar las baterías.....	300 00
Gasto total por año *sin* contar el valor del dynamo i de las baterías..........................	$ 4401 75

He aquí el costo anual para alimentar 250 lámparas 6 horas por dia durante 300 dias por medio

de baterías. Es necesario observar que en esta cuenta solo se han cargado los intereses, depreciacion de la instalacion i costo del combustible.

"Comparemos ahora el mismo servicio practicado con un sistema directo de electricidad, e *incluyendo* el costo del dynamo, i veamos que resultado se obtiene:

Costo del dynamo............	$ 3000 00
Intereses i depreciacion 10 %...	300 00
Este dynamo alimentando lámparas directamente requerirá 35 caballos, i para 6 horas un total de 210 caballos. Aceptando como en el caso anterior que cada caballo necesite 4 libras de carbon, resultará un consumo diario de 840 libras, o sean 252,000 libras en 300 dias, o 126 toneladas anuales, que a 4 pesos 50 centavos por toneladas hacen....................	567 00
Gasto anual total $ 867, e, *incluyendo* el costo del dynamo no se llegaria sino a................	$ 3867 00

o $ 534 75 ménos que el simple costo de hacer el mismo servicio con el sistema de baterías. Si se toma en consideracion el valor del dynamo, i de la batería en el caso del sistema indirecto, se llega a la suma de $ 12,975 para la instalacion,

contra $ 3,000 que importaria nuestro sistema directo. ¿He conseguido esplicar a Ud. claramente el problema?

"Esos son los individuos que proclaman en pomposas circulares que pueden iluminar molinos i otros establecimientos industriales con solo instalar en ellos un pequeño dynamo que funcione ocho horas, i almacenando su electricidad desarrollada, evitando de esta manera el costo de una dispendiosa instalacion que alimentase directamente las luces. Probablemente esos individuos objetarán que yo pongo mui subido precio a las baterías; consentirán para probarlo en vender esas baterías por mucho ménos; i no seria raro que hicieran lo que en Inglaterra se hizo con la lámpara de Lane-Fox, que era vendida a las compañías subsidiarias en grandes cantidades a razon de 5 chelines, miéntras que su costo de fabricacion era de 12 chelines!"

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Agregamos a la opinion del señor Edison, que por algunos se podrá considerar parcial en este caso, la del eminente electricista Gordon, poco entusiasta, como buen ingles, de lo que se hace en la novel América (1).

PÁJ. 189. CAPÍTULO XVI. EL ALMACENAMIENTO DE LA ELECTRICIDAD.—BATERÍAS SECUNDARIAS.

"Los resultados obtenidos en el almacenamiento de los gases en gasómetros, *ad-hoc* han sujerido a muchos inventores la idea de poder almacenar la electricidad, o mas bien, la enerjía eléctrica de una manera semejante.

"La única manera bajo la cual podria ser almacenada la electricidad directamente, seria

(1) A. Practical Treatise on Electric Lighting by J. E. H. Gordon, B. A., M. S. T. E.
Miembro del Congreso de electricistas de Paris en 1881, etc., etc., 1884.

aislando dos conductores i cargándolos respectivamente positiva i negativamente. Poniéndolos en seguida en coneccion, por medio de un alambre conductor, es evidente que se estableceria una corriente al traves de dicho alambre, corriente que duraria hasta que las presiones se igualaran. Para aprovechar la corriente en la iluminacion, no habria sinó intercalar en el circuito una lámpara.

"Por supuesto que el método es impracticable a causa de la dimension enorme que deberian tener los conductores, para que pudieran almacenar una carga que pudiese ser apreciable aunque por cortísimo tiempo.

"Los dos conductores deberian estar dispuestos como los de un condensador o botella de Leyde; forma bajo la cual se puede almacenar mayor cantidad de electricidad, pero no tal que pueda prestarse a usos prácticos.

"Viéndose, por lo tanto, que el almacenamiento de la corriente eléctrica es impracticable, las investigaciones se encaminaron hácia otros métodos de almacenamiento de una enerjía potencial, bajo una forma que permitiera convertirla en enerjía eléctrica en el momento deseado.

"Esta enerjía potencial podria ser jenerada de distintas maneras, i la enerjía gastada para producirla podria ser o una enerjía eléctrica o una enerjía de cualquiera otra especie.

"Por ejemplo, la enerjía potencial que se tratara de almacenar para aprovecharla bajo la forma de enerjía eléctrica, podria ser la enerjía química latente en el zinc i en el ácido de una batería voltaica ordinaria; o podria ser la enerjía mecánica i química respectivamente del vapor listo bajo presion en un caldero i del carbon listo para ser arrojado dentro de la hornilla.

"Si se quisiera producir una enerjía potencial para almacenarla, por medio de una enerjía eléctrica, podríamos emplear una corriente eléctrica que accionando sobre un motor hiciera que éste comprimiera aire o elevase agua hasta ierta altura; de tal manera que el aire o el agua pudieran a su vez obrar sobre un dynamo; o bien se podria emplear la corriente en producir una carga química en una batería secundaria.

BATERÍAS SECUNDARIAS.

"El señor Planté ha en contrado que si se colocan dos hojas de plomo convenientemente preparadas en una disolucion de ácido sulfúrico dilüido i se conectan respectivamente con los dos polos de un dynano, se produce un efecto químico en ellas tal que se comportan a su vez como una batería voltaica, produciendo una cantidad de enerjía eléctrica que viene a ser una considera-

ble fraccion de la corriente total del dynamo que se empleó para cargarlas.

"Siendo engorroso el método empleado para preparar el plomo, el señor Faure inventó una batería compuesta de simples planchas de plomo cubiertas de *minio* o óxido rojo de plomo. Este invento produjo en 1880 gran exitacion en Inglaterra a causa de un suelto que pudo leerse en el Times, en el cual se anunciaba que se habia llevado de Paris a Lóndres, en una pequeña maletita, 1.000,000 de *pié-libras* de enerjía eléctrica.

"El tal millon parece ser una enorme cantidad; pero para formarnos una idea exacta de su magnitud, debemos hacer notar que su equivalente en unidades comerciales, i al precio máximo autorizado por la Cámara de comercio del distritode San James, vale "two-pence half penny" (poco mas de cinco centavos.)

"En estos últimos tiempos se han patentado un inmenso número de modificaciones en las baterías secundarias; pero hasta ahora no hemos podido ver una sola batería secundaria que funcione con mediano éxito. Aun *recientemente cargadas*, no devuelven un 75% de la enerjía que se empleó para cargarlas.

"En segundo lugar, estas baterías no conservan su carga. He podido observar que si se carga una batería i se guarda durante una semana, su rendimiento disminuye considerablemente. Estas pérdidas se deben a acciones químicas locales, que tienen lugar en el interior de las baterías.

"En tercer lugar, las baterías secundarias se destruyen rápidamente siendo necesario renovar el plomo al cabo de pocos meses.

"En cuarto lugar, el costo primero de instalacion por cada unidad de enerjía eléctrica que pueden almacenar (bajo la forma de enerjía química) es mui subido.

No hai duda que los intereses i depreciacion en una instalacion de baterías secundarias con poder suficiente para producir una iluminacion eléctrica, son con mucho mas subidos que los intereses i depreciacion correspondientes a una *doble* instalacion de motores, calderos i dynamos.

"Cuanto mas estudiemos la cuestion del almacenamiento de la enerjía eléctrica, tanto mas nos convenceremos de que la mejor forma de enerjía potencial almacenada está en la enerjía potencial del carbon de piedra i vapor comprimido; i que el mejor aparato para efectuar el dicho almacenaje es un buen caldero listo para actuar sobre un motor i un dinamo.

"La enerjía potencial contenida en una batería, rápidamente desaparece. Con los calderos no sucede lo mismo. Los motores son com-

parativamente baratos i mui durables; las baterías son mui caras i no duran.

"El único aparato de almacenamiento digno de llamarse así es un sólido caldero lleno de vapor con una buena hornilla i en coneccion con un motor i un dynamo, mantenidos caldeado el uno i bien aceitados los otros para ponerlos en movimiento en el momento requerido."

COMPAÑIA ELÉCTRICA DE EDISON

AJENCIA JENERAL PARA

CHILE, PERU Y BOLIVIA

106—CALLE COCHRANE—106

VALPARAISO

Luz Eléctrica de Edison

SISTEMA CANDENTE

PRIVILEJIADO POR EL SUPREMO GOBIERNO DE CHILE

VALPARAISO
IMPRENTA EXCELSIOR
14-CALLE SERRANO-14
1885

Luz Eléctrica de Edison

SISTEMA CANDENTE

PRIVILEJIADO POR EL SUPREMO GOBIERNO DE CHILE.

El sistema Edison de alumbrado eléctrico por candencia es tan bien conocido en esta costa, que cualquiera descripcion sería superflua. La esperiencia de todos los que han usado esta luz es, que no solamente es la mas *Segura*, la mas *Hermosa*, la mas *Clara* y *Pura* luz que existe, sino tambien la mas *Barata*.

MAQUINAS, DINAMO-ELECTRICAS, del sistema Edison, son fabricadas en los siguientes tamaños:

Para	25	lámparas	de	16	velas	o	40	de	10	velas.
,,	50	,,	,,	16	,,	,,	80	,,	10	,,
,,	100	,,	,,	16	,,	,,	200	,,	10	,,
,,	150	,,	,,	16	,,	,,	275	,,	10	,,
,,	200	,,	,,	16	,,	,,	350	,,	10	,,
,,	300	,,	,,	16	,,	,,	500	,,	10	,,
,,	400	,,	,,	16	,,	,,	800	,,	10	,,
,,	1200	,,	,,	16	,,	,,	2000	,,	10	,,

Como tambien, máquinas dinamos combinadas de lento andar y máquinas verticales a vapor para el alumbrado de buques. Estas máquinas son mui eficaces y ocúpan mui poco espacio.

Todos estos dinamos dan una corriente de *baja tencion* o fuerza eléctromotriz, con perfecta seguridad para las vidas y propiedades.

Las máquinas, alambres o efectos pueden ser tomados con la mano desnuda sin riesgo ninguno. Tambien están provistos con reguladores automáticos, por lo cual la cantidad de corriente suministrada es siempre lo justamente necesario para que las lámparas sean consumidas a la fuerza normal de la vela.

Estas máquinas son especialmente adoptadas para alumbrar *casas particulares*, *haciendas*, *molinos*, *fábricas*, *buques*, *edificios públicos*, *cervecerias*, *destiladerias*, *minas*, etc.

EL SISTEMA DE APOSTADERO CENTRAL DE EDISON.

Por este sistema una corriente de electricidad fija y continua es suministrado a toda las casas. casas de negocios o fábricas de un pueblo o ciudad, cuya corriente puede ser utilizada en la produccion de Luz, Calor, o Fuerza Motriz.

Mas de *treinta* de las Estaciones Centrales de Edison están actualmente funcionando en varias partes del mundo, y muchas hai en construccion. Esta Compañía está lista para instalar tales Estaciones en Chile, Perú y Bolivia, suministrando y montando todo el material. Donde hai fuerza hidráulica, estas Estaciones pueden ser establecidas a mui poco costo, y pueden suministrar corriente eléctrica para alumbrado y fuerza a precio excesivamente bajos.

Electrolabras y todos los útiles para la luz de Edison de todas clases.

Lámparas de 32, 50 y 100 velas cada una pueden ser usados al mismo tiempo que los de 10 o 16 velas en lugares donde se desea una luz concentrada.

Presupuestos para toda clase de trabajo serán dado con placer a los que lo soliciten. Es necesario dar siempre el número y la clase de luces que se necesitan, y para qué uso, un diseño del local que se va alumbrar, con las dimensiones y alturas del techo, y los pormenores de la clase y cantidad de fuerza motriz que se puede disponer para funcionar el dinamo.

INSTALACIONES DE EDISON EN CHILE.

Santiago. Estacion Central..........	2500 lámps.
Los Anjeles ,, ,, ...	200 ,,
Santiago, Sra. de Cousiño, casa quinta.	300 ,,

Viña del Mar, Gran Hotel...........	225	lámps.
Santiago, Sr. V. Echáurren Valero, casa	100	,,
,, ,, Ben. Velasco, molino y casa	60	,,
,, Molino Santiago........	60	,,
,, San· Cárlos............	60	,,
,, Fábrica de Lana........	65	,,
Graneros ,, Velasco, molino y casa....	60	,,
Linderos ,, Enrique Lanz...........	60	,,
Bulnes, molino Bulnes..............	60	,,
Talca, Sr. Luis Williams, Alambique.	50	,,
Valdivia, Anwadter Hnos., Cervecería.	60	,,
Quillota, Fábrica de Papel..........	50	,,
Santiago, Universidad de Chile.......	25	,,

Nota.—El sistema de Edison de alumbrar por la candencia de un filamento de carbono encerrado dentro de un globo de cristal privado del aire, es protejido por privilejio esclusivo concedido por Supremo Gobierno de Chile. La produccion, regulacion, y distribucion de corrientes eléctricas para el suministrar luz, calor o fuerza es tambien protejido por privilejio. Compradores o consumidores de estas lámparas o aparatos que infrinjan estos derechos son respetuosamente notificados de que serán personalmente responsables.

LAMPARA DE ARCO, SISTEMA EDISON.

Estamos preparados para suministrar máquinas y enseres para el alumbrado de arco, donde el se pueda necesitar. Máquinas desde 2 a 20 lámparas cada una, de 1200 o 2000 velas de fuerza. Estas lámparas son adaptadas para alumbrar calles, plazas, o cualquier local grande y descubierto. Estas máquinas son vendidas a precios mucho mas bajo que lo pedido por otros fabricantes. Mandad por pormenores y presupuestos, dando todos los pormenores, como arriba indicado.

TRASMISION DE FUERZA MOTRIZ POR ELECTRICIDAD.

Los mismos dinamos usado para la produccion de luces de arco o candentes pueden ser usados para la trasmision de fuerza motriz por medio de la electricidad. Esto se hace colocando en cualquiera parte del alambre que viene del dinamo un motor eléctrico de la fuerza que sea requerido. Estos motores pueden usarse separadamente o en conexion de un circuito alumbrador, cosa que así el mismo dinamo puede trasmitir fuerza motriz y producir luz. Estamos preparados para suministrar motores de Edison o los de

THE SPRAGUE ELECTRIC RAILWAY & MOTOR COMPANY

de los siguientes tamaños: 1/10, ¼, 1, 1½, 3 y 4 caballos. Tamaños mayores estarán listos mui luego.

Estos motores son empleados para funcionar ventiladores, bombas, barrenos y toda clase de maquinaria. Poseen las siguientes ventajas sobre todas otras previamente construidas:

1.° Pueden principiar a funcionar con lentitud, con o sin carga, y sin saltar.

2.° Funcionan con escobillones en una posicion fija, y sin chispear o gasto sobre el conmutador.

3.° Funcionan con solamente una variacion de dos por ciento en el andar siéndole indiferente el peso de su carga.

4.° Son tan perfectamente automáticos en su accion y tan sencillos que un niño puede hacerlos funcionar.

Al ofrecer estos motores, por la cual la fuerza de los alambres puede ser trasmitido tan económicamente por largas distancias, la Compañía cree que ninguna invencion moderna ofrece mas garantías al porvenir industrial de las Repúblicas de la costa Occidental.

Precios y todo pormenor será suministrado con placer. Se solicita correspondencia.

FERRO-CARRILES ELECTRICOS.

El gran triunfo obtenido por los ferro-carriles eléctricos en Berlin, Giants Causoway, en Irlanda, Brighton, Inglaterra, Cleveland en Estados Unidos, y en la quinta de Mr. Edison en Menlo Park, ha estimulado mucho en inquerir en este sentido, y muchas nuevas líneas están en via de construccion. Son especialmente adaptadas para el uso en minas, líneas urbanas, establecimientos salitreros, etc., y particularmente donde las pendientes son mui pesadas. El señor Edison tiene un *privilejio esclusivo* en Chile para toda clase y forma de líneas ferreas eléctricas y ésta Compañía está preparada para construir y equipar líneas de ésta naturaleza, siempre que no excedan de dos leguas, y garantiza resultados perfectos; estas líneas ofrecen grandes economías, cuando existe fuerza hidráulica sobre el uso de vapor o caballos, Se proporcionan presupuestos y pormenorés.

CALDERAS Y MAQUINAS A VAPOR.

El estensivo uso de la luz eléctrica ha traido a la existencia varios nuevos tipos de máquinas a vapor de lijero andar, tantos horizontale como verticales. Estamos preparados para suministrar estas máquinas para todo empleos y a precios ínfimos garan-

tizando una *absoluta regularidad* en el *andar y movimiento, gran economia de vapor, sencillez* y *solidez* en su *construccion*.

El tubo de agua y calderos a vapor *inexplosible* del sistema Babcock y Wilcox está dejando mui atrás a todo los demas en todas partes del mundo. Son baratos a primer costo, consumen menos combustible, absolutamente seguro, y de la mas aprobada construccion. Nosotros suministramos estos calderos de cualquier tamaño que se desée.

TELEFONO ACUSTICOS.

Los teléfonos acústicos de la Compañia Consolidado de Teléfonos son mui superiores a los instrumentos eléctricos para distancias cortas, media legua o ménos. Los instrumentos son lujosamente hechos, y estan previstos de campanillas eléctricas o magnéticas.

Estos instrumentos no tienen rival para comunicarse entre las varias partes de una fábrica o molino, o de las haciendas a las casas esteriores, etc.; completamente garantidas.

Precio: 2 instrumentos $ 150; alambre especial, 10 centavos metro. No hai contribucion.

MOTORES DE GAS.

Los célebre motores de Gas, "Otto" son mui usados para mover los dinamos para la produccion de luz eléctrica y fuerza motriz. Como el gas produce mas calor que luz, es mas económico usar luz eléctrica producida por un motor de gas, que usar el gas para alumbrado.

Los motores de Gas no necesitan ningun hombre competente para manejarlos, y en ciudades grandes su uso se está haciendo mui comun.

Nosotros suministramos motores de gas, sistema "Otto" hasta 30 caballos de fuerza, y tenemos diseños especiales adaptables para el alumbrado eléctrico.

LAMPARAS ELECTRICAS DE EDISON, EN MINIATURA.

Lámparas chicas de Edison, se hacen ahora de los siguientes tamaños: $\frac{1}{2}$, 1, 2, 3, 4 y 6 velas de poder cada uno, y en diseños especiales para dentistas y cirujanos. Baterias y productos químicos tambien se fabrican. Prendedores para corbatas, incluyendo el alfiler, lámparas, baterias para el bolsillo y el fluido, boton de empuje y conexiones, $ 25 cada uno. A los joyeros y otros se hacen descuentos.

FONOGRAFO PARLANTE DE EDISON.

Este hermoso y perfeccionado instrumento es ahora fabricado de modo que todo los tonos e inflecciones de la voz humana, música, etc., puedan ser correctamente reproducidos en cualquier tiempo. Precio: $ 350 con un surtido de hoja de estaño.

MISCELANEA

Estamos preparado para suministrar a los mas bajos precios el siguiente material:

Alambre de fierro y cobre para todo uso eléctrico;
Aisladores de cualquier diseño;

Campanillas eléctricas, anunciadores y materiales para los mismos;

Alambre aislado para todo trabajo eléctrico contra fuego y contra agua. Baterias o Pilas Eléctricas de Bergmann Galvanic Batteries, superior a los de Leclanché y mucho mas baratos;

Instrumentos Telegráficos;

Herramientas e instrumentos usados en trabajos Eléctricos;

Libros y publicaciones sobre electricidad;

Aparatos para señales en ferro-carriles.

Tenemos en nuestro empleo un cuerpo de injenieros y empleados que han tenido mucha esperiencia

en trabajos eléctricos en esta costa: este solo hecho asegura el pronto y satisfactorio cumplimiento de todo trabajo encomendado a nuestro cuidado.

Se solicita correspondencia. Precio por cualquiera de los materiales arriba indicado serán dado a los que lo soliciten de la

COMPAÑIA ELECTRICA DE EDISON.

106—Calle Cochrane—106

Valparaiso.

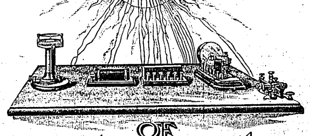
Edison Phonoplex System

This folder contains printed material relating to Edison's phonoplex system. This system of railway telegraphy devised by Edison in the 1880s combined features of the telegraph and telephone. Related material can be found in D-85-046 and D-86-039 (Document File Series) and in Phonoplex Letterbooks, LM-012 and LM-013 (Letterbook Series).

The following item has been filmed: "Edison Phonoplex System of Telegraphy" (ca. 1886).

6215-14

Edison Phonoplex System



# of Telegraphy.

SAMUEL INSULL, Manager. A. O. TATE, Electrician.

EDISON

PHONOPLEX SYSTEM OF TELEGRAPHY.

ECONOMY.

Saves the cost of erection of new lines.

SAFETY.

Phonoplex circuits *cannot be left open.*

ADAPTABILITY.

Circuits may be arranged to suit almost every requirement and combinations formed *which cannot be effected by means of any other known system of Telegraphy.*

SIMPLICITY.

The Instruments are easily controlled by ordinary operators.

PRACTICABILITY.

We send with this issue of the Phonoplex Pamphlet copies of letters we have received from a few of our licensees, which show that *all our claims for the System have been fully proved by practical experience.*

Address all correspondence to

EDISON PHONOPLEX SYSTEM OF TELEGRAPHY,

~~40 and 42 WALL STREET~~, - - ~~NEW YORK CITY~~.

Orange N. J.

THE EDISON

PHONOPLEX SYSTEM OF TELEGRAPHY

meets a requirement that has long been manifest in telegraphic circles. The ordinary duplexing of a wire, which increases facilities between terminal points only, has been largely applied, but until Mr. Thomas A. Edison devised this new method of transmission no means were available by which the capacity of intermediate offices on a single Morse circuit could be increased. Through the use of the Phonoplex system extra circuits are provided, by means of which more than double the amount of service may be derived from a single wire than is at present obtained, while its extreme simplicity of detail and adjustment places it within the easy control of ordinary operators.

PRINCIPLE.

The principle upon which the system is operated is induction. The instruments employed for signalling respond only to induced currents thrown upon the line by transmitting devices, which currents interfere in no way with Morse instruments in the same circuit, being made to pass around them through condensers, while Morse waves in turn have no perceptible effect upon the Phonoplex apparatus; thus, two or more independent circuits may be provided on a single wire, as will be more fully explained hereafter.

LENGTH AND ARRANGEMENT OF CIRCUITS.

This system of telegraphy can be operated upon circuits ~~not exceeding~~ one hundred miles, or thereabouts.

All or any desired number of intermediate offices may be doubled in their capacity, or communication can be established

"We have in some cases been able to work the phonoplex when the line was interrupted so as to be useless on the Morse side." J. W. LATTIG, Supt. Telegraph, Lehigh Valley R. R. Co.

between terminal points only, regardless of whether such points are intermediate offices on a Morse wire, or Morse terminal stations. In short, between such offices as are equipped with the Phonoplex, an extra circuit is provided, the same as though an additional wire had been strung.

RAILWAY LINES.

The delays which are attendant upon the transmission of business over railway wires, on account of the more important work of train dispatching, may be avoided by providing Phonoplex circuits as outlets to relieve the Morse line.

On roads which employ only one wire, another great advantage that will be more fully explained later on, lies in the fact that Phonoplex circuits can never be left open, neither through their own instruments nor those of the Morse line. The opening of a Morse key in the same circuit has no effect upon the phonoplex system, the latter remains intact so long as the wire is not broken. Thus a fruitful source of delay and ofttimes serious interruption of the roadway itself is provided against by this system.

COMMERCIAL WAY WIRES.

The Phonoplex System is especially adapted to the requirements of way wires, the conditions on which, regarding delay through overcrowding and the opening of keys, being identical with those mentioned in connection with railway lines.

Many of these wires are strung between a number of important points, tapping in their course offices of less importance, and the Phonoplex, which permits the inclusion or exclusion of any or all intermediate stations, may be operated either wholly or partially as a through circuit, with the object of relieving the pressure at certain points only, or, where necessary, doubling the capacity of the whole line.

THROUGH WIRES.

On wires exceeding one hundred miles in length, phonoplex circuits may be added, the first starting at the initial office and

doubling the capacity to a distance of one hundred miles beyond, including or excluding intermediate stations; the second commencing where the first ends and continuing one hundred miles further, and the third and fourth following in turn under like conditions. Thus any number of extra circuits may be added to a long wire for the purpose of absorbing local business, which as a rule circulates within a radius not exceeding one hundred miles of its source. In addition to this Phonoplex circuits may be established between two or more offices on a wire, whether they be intermediate or terminal, without necessarily equipping any other portion of the same system.

DUPLEX AND QUADRUPLEX WIRES.

The Phonoplex System can be applied to duplex or quadruplex wires and operated from the same terminals, or intermediate offices may be cut in and permitted to work, as on an ordinary Morse circuit, without interfering with the operation of duplex or quadruplex instruments at either end. This enables a long stretch of wire to be utilized, which at present serves only two separate points.

CONDITIONS OF LINE.

In wet or heavy weather, when Morse wires are rendered almost unworkable through the presence of heavy escapes, the Phonoplex circuits on the same lines are not in the least impaired. Instances have been frequent where Morse signals could be transmitted only half the length of a wire, owing to the cause mentioned, while the Phonoplex system was operated the whole distance the same as under the most favorable conditions.

APPARATUS.

The apparatus for the equipment of an office consists of a key, transmitter, magnetic coil, small resistance box and the phone—which last responds to incoming signals; two condensers, two cells of gravity battery and four of electropoin, and the whole is arranged to occupy no more space than ordinary Morse instruments.

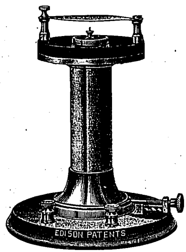
"The advantages claimed for the system have been "clearly demonstrated on our lines by practical experience."

H. P. DWIGHT, Genl. Manager,
Great N. W. Tel. Co., Toronto.

GENERAL DESCRIPTION OF THE COMPONENT PARTS

OF THE

PHONOPLEX SYSTEM OF TELEGRAPHY.

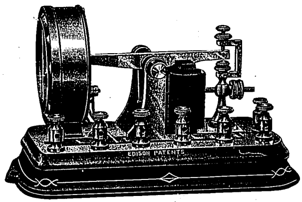


The Phone.

The above cut represents the phone. A hollow column of brass resting upon a wooden base encloses the magnets. At the lower end is a rack and pinion by which these can be adjusted with reference to the diaphragm. To the centre of the latter there is attached a screw-threaded pin with thumb nut and binder at the top and encircling the pin loosely is a split-

hardened steel ring which rests upon the diaphragm. When the latter is snapped by the attraction of the momentary current in the magnet it throws the ring violently against the stop nuts and produces a sharp, loud click. The steel ring has a pin projecting from its side that passes between two prongs, which, while permitting free up and down motion, prevents the ring from turning and altering the sound.

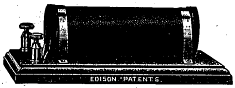
Over the top of the phone there is clamped a thin brass plate as a protection for the projecting screw.



The Transmitter.

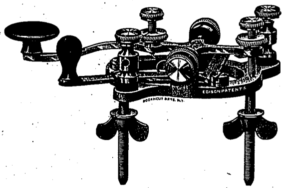
This device is interposed between the key and the magnetic coil. The former operates the magnet of the transmitter, the object of which is to send uniform currents to the line and also to short-circuit the phone each time the coil battery circuit is broken, and thus obviate the annoyance which would otherwise be caused by the violent discharge close to the diaphragm.

"I consider it well worth the money that we have agreed "to pay you for it." CHAS. R. HOSMER, Manager, Canadian Pacific Ry. Telegraph.



The Magnetic Coil.

In a small magnet is stored the energy which is exerted on the line for the purpose of operating the phones. As it is necessary to produce an instantaneous discharge, a condenser is connected around the points of the transmitter, which makes and breaks the circuit around the coil.

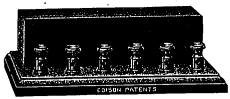


The Key.

The key is so constructed that when the lever is "opened" or thrown to the right, it closes the circuit around the magnetic coil through the points of the transmitter, and when "closed" or thrown to the left, it opens this battery and at the same time short-circuits the magnetic coil. The necessity for this lies in the fact that an open circuit electro-poin battery of low resistance is employed, which it is desirable to use only when occasion requires the transmission of signals, and also

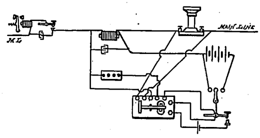
that the resistance of the coil has an audible effect in the phone when it remains in the line to retard incoming currents.

Thus, while the manipulation of the key accomplishes all the objects it is desirable to attain, it introduces no innovation, as the same movements to which operators are accustomed are maintained—"opening" for the transmission and "closing" for the reception of business.



The Resistance Box.

A small resistance box is interpolated in such a way that when the current through the magnetic coil is broken on the up-stroke it passes through the spools. This is to produce an audible distinction between the up and down movement as manifested in the phone, the former being lighter than the latter, so as to prevent confusion that otherwise would be occasioned by operators getting the "back-stroke."



The above diagram shows all the instruments in place. All Morse keys and relays within the limits of a phonoplex circuit are bridged, as represented, by a condenser through which pass

"The phones are in daily use, and with very good "results."

C. A. DARLTON, Supt. Telegraph,
Richmond & Danville R. R. Co.

the induced currents that operate the phones. It will be readily seen that the main line, which passes through the magnetic coil and through the phone, is never broken, the former being charged and discharged by means of an extra circuit around it through its key and the points of the transmitter.

This explains our previous statement to the effect that a phonoplex circuit remains intact so long as there is no actual breakage of the wires to which it is attached.

DIAGRAMS OF VARIOUS METHODS

OF

ESTABLISHING EXTRA CIRCUITS ON MORSE WIRES

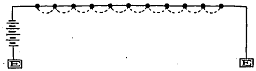
BY THE USE OF

THE PHONOPLEX SYSTEM OF TELEGRAPHY.

The following diagrams will illustrate the manner in which extra circuits may be derived on Morse lines.

COMMERCIAL WAY OR RAILWAY WIRES.

DIAGRAM No. 1.



The black line represents the established Morse circuit.
● represents the offices through which it passes.
The dotted line represents the extra phonoplex circuit.

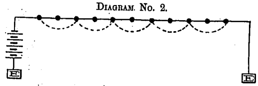
The above diagram shows all offices equipped and doubled in their capacity.

In order to understand thoroughly the advantage derived from these extra circuits, as shown in the above and following diagrams, it is only necessary to bear in mind the fact that a phonoplex circuit provides facilities between such points as are included in it, the same as though an additional wire had been strung without reference to the line to which it is attached.

"We are working both (Morse and Phonoplex) on the "circuit in question, with great advantage to the telegraph "business of the Company."

J. W. LATTIG, Supt. Telegraph,
Lehigh Valley R. R. Co.

DIAGRAM No. 2.



The above shows half the offices doubled in their capacity.

Those which are touched by the dotted line can communicate with each other either on the Morse side or by means of the phonoplex circuit.

In the "blind" stations—those which the dotted line avoids—the keys and relays are bridged by condensers to afford a channel through them for the phone currents. They can at any time be included in the phone circuit by the introduction of the necessary instruments.

DIAGRAM No. 3.

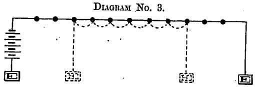


Diagram No. 3 shows a phonoplex circuit established between intermediate offices.

The induced currents which operate the phones in this circuit are thrown to the ground at the phonoplex terminal stations through condensers. Thus it is not necessary to bridge the keys or relays of offices outside these points.

DIAGRAM No. 4.

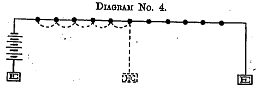


Diagram No. 4 represents a wire equipped to half its length with the phonoplex system.

DIAGRAM No. 5.

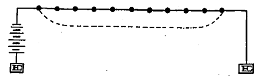


Diagram No. 5 illustrates a through phone circuit established on a way wire.

DIAGRAM No. 6.

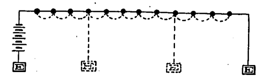


Diagram No. 6 represents a through wire three hundred miles in length and illustrates the manner in which three extra phonoplex circuits, each of one hundred miles, may be established for the purpose of absorbing local business.

DIAGRAM No. 7.

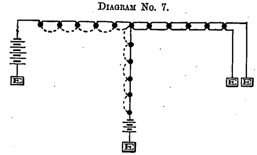


Diagram No. 7 shows two Morse wires running in different directions, but parallel for a portion of the distance.

"The advantages accruing to us by the use of your "Phonoplex instruments equal the same privileges as we "obtained from a regularly equipped Morse line."

:O. W. STAGER, Supt. Telegraph,

Phila., Reading & Pottsville R. R. Co.

The first is phonoplexed to half its length, and the induced currents are then thrown into the second wire and pass through a partial number of its stations. In this way communication is established between a number of offices on each wire which otherwise are unable to work direct with each other.

DIAGRAM No. 8.

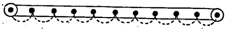


Diagram No. 8 represents a Morse duplex circuit, the wire passing intermediate offices.

The illustration shows how communication may be established between these intermediate stations, or any of them, by cutting them in on a phonoplex circuit annexed to the duplex wire.

DIAGRAM No. 9.

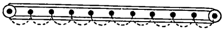


Diagram No. 9 in the same manner illustrates the phonoplex system applied to a quadruplex line for the purpose of utilizing it as a way wire.

It will be readily seen from these few illustrations that the phonoplex system is capable of a great variety of convenient combinations, which it would be impossible to effect by means of any other known system of telegraphy.

MAINTENANCE.

The cost of maintenance is very slight. The only actual outlay required is for the provision of battery material. Of course this expenditure varies with the amount of work done, but, assuming the phonoplex transmitter to be in constant operation for twelve hours during each of the thirty days, the cost of renewing the battery will not exceed one dollar and fifty cents ($1.50) per month.

PRICE LIST.

Instruments may be procured direct from the authorized manufacturers, who have furnished the following quotations:

Phone	$10.50
Magnetic Coil	1.85
Transmitter	8.50
Rheostat	1.85
Key	2.50
Coil Condenser	~~8.00~~ 10.00
Bridge Condenser	~~10.00~~ 12.00
Battery (per cell complete)	1.75

Edison Speaking Phonograph Company

This folder contains printed material issued by, or relating to, the Edison Speaking Phonograph Company, which was organized in 1878.

The following items have been filmed:

1. "Instructions for the Management and Operation of Edison's Speaking Phonograph" (1878)
2. "Edison's Speaking Phonograph. Instructions for Operating Experimental Apparatus" (ca. 1878)
3. "Edison's Parlor Speaking Phonograph. Instructions." (ca. 1878)
4. Miscellaneous circulars and other items relating to the exhibition of Edison phonographs (1878, 1881?)

INSTRUCTIONS

FOR THE

Management and Operation

OF

EDISON'S

SPEAKING PHONOGRAPH

PHILADELPHIA:
BURK & McFETRIDGE, STEAM-POWER BOOK AND JOB PRINTERS, 804 CHESTNUT STREET.
SUCCESSORS TO INQUIRER PRINTING HOUSE.

1878.

EDISON'S

SPEAKING PHONOGRAPH.

DESCRIPTION AND INSTRUCTIONS FOR OPERATING.

The adaptation of this wonderful discovery to the practical uses of commerce and social life not having, as yet, been completed, in all its mechanical details, this company is prepared to offer to the public only that design or form of apparatus which has been found best adapted to its exhibition as a novelty.

Of this class of Phonographs, we make two styles: One for the general purpose of exhibition, and one for the drawing room and scientist's sanctum.

The mechanism of each is precisely the same. The performance differs only in these particulars:

No. 1. The exhibition instrument has a cylinder grooved with twenty-four threads per inch.

No. 2. The drawing room instrument has a cylinder grooved with forty threads per inch.

This gives to No. 2, the advantage of nearly double the recording surface on a cylinder of the same size. It also adds a trifle to the distinctness of the articulation, and approximates more nearly the quality of the voice.

In point of volume of sound, and in general effectiveness in illustrating the working of the apparatus to an assemblage of any considerable number of people, there is no appreciable difference between them.

No. 1. Is all of iron, except the cylinder, which is of brass. The iron work is all neatly japanned and ornamented. It is mounted upon a neat white wood box, in which is a drawer for the small tools and supplies which accompany each machine.

No. 2. Is all of brass, hand-filed and beautifully finished throughout. The fly-wheel, base, etc. being of brass, the instrument is given a rich appearance. It is mounted upon a handsome rosewood and inlaid box, with drawer for tools.

Each instrument is furnished with the following list of Foil, tools, etc:

1. This Letter of Instructions.
2. 5 pounds of special made Record Foil.
3. 1 Oil Stone.
4. 1 Oil Can.
5. 1 Screw-Driver.
6. 1 Centering Pin.
7. 1 Funnel.
8. 1 piece Rubber Cushion.
9. 1 " " for wedge.
10. 1 " Wax Cement.
11. 6 Prepared Stylus'.

Each instrument is packed for shipment in a neatly made box, of 1½ inch stuff, water tight, and with heavy iron handles on the ends. The instrument is so braced in this box as to render its damage in transit well nigh impossible. The outside dimensions of this box, are

Length—2 feet 10 inches.
Width—1 foot 2 inches.
Depth—1 foot 2 inches.
Total weight of instrument and box, 175 pounds.

When properly adjusted the Phonograph will speak loud enough to be distinctly heard by an audience of from three to five thousand people. It is the *character* of the sound that makes this possible, apparently it is barely a fourth as loud as the original voice, yet its "voice" may be heard at an almost equal distance.

Price of No. 1 Instrument, $
" " 2 " $

Terms, part payment in advance, balance C. O. D. No discounts.

No Phonographs loaned or rented.

The Record Foil especially manufactured for the Phonograph, may be had of S. Bergmann & Co., 104 Wooster St., New York. There are thirty sheets to the pound.

It is put up only in 5, 10 and 20 pound boxes. Not more than 20 pounds can be shipped safely in *one* box.

Price, 45 cents per pound. Boxing, 25 cents.

Terms, one-half cash in advance, and balance C. O. D.

Extra Stylus' and Diaphragms may also be had of the same parties.

Price of Stylus', 15 cents each.
" Diaphragms, 10 cents each.

It is very rare for a Diaphragm to give out: in point of fact they improve by use, and are only damaged by carelessness or accident. No other parts ever require renewal.

DESCRIPTION.

Explanation of figures in accompanying drawings.

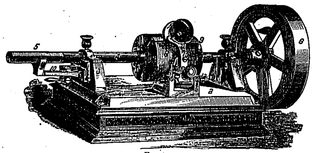


Fig. 1.

1. A box to elevate the instrument to accommodate the fly-wheel which is higher than the instrument proper. This box is furnished with a drawer for tools, etc.
2. The framework of the machine.
3. Two smooth bearings for the shaft.
4. Cast-steel shaft carrying the cylinder.
5. A screw thread upon the end of the shaft, to give the instrument a gradual lateral motion whilst being rotated.
6. Heavy fly-wheel, to give a uniform motion. (Very important.)
7. The cylinder upon which the foil is placed to *receive* and *reproduce* the sound.
8. A screw thread or groove corresponding to that upon the shaft, the object of which is to remove all *support* from under the *foil* at the *precise point where the stylus presses upon it.* Thus permitting the foil to be more readily indented by the stylus than would be possible if the surface underneath the foil was solid.
9. A slot cut across the cylinder to receive the two ends of the foil, and a steel and rubber rod or wedge, which is pressed in on the foil to hold it.

10. An adjustable arm working upon centres, held downward by a flat steel spring, and forced upward by a cam movement, the function of which is to hold a half nut either *in* or *out* of the thread upon the shaft, as it may be desired to carry the cylinder forward with the nut, or slip it back free of it.

11. An upright arm for holding the mouth-piece, diaphragm and stylus combination in proper position.

12. Centre screws for moving the mouth-piece to the right or left, as may be required to bring the stylus to a position *exactly in the centre of a groove.*

13. A screw for regulating the depth of the groove made in the record foil by the stylus.

14. A cam (adjustable), to lock the upright arm in position, while a record is being made or reproduced.

Figure 2.

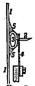


Fig. 2.

1. Diaphragm of mica—a thin plate which vibrates in unison with the voice, or other sounds thrown upon it.

2. A stylus or needle-point for recording the movements of the diaphragm upon the foil, and for re-traversing the record thus made, and giving back to the diaphragm its original vibratory movement, and consequently reproducing the sounds.

3. A cushion made of rubber tubing, the function of which is to destroy the too metallic sound which is had from direct metallic contact between the stylus and plate.

4. A steel spring to hold the stylus rigidly in position, weakened near the base so as not to exert any pressure upon the diaphragm.

5. Wax—so placed as to hold the cushion very firmly to the plate, and also the stylus spring firmly to the cushion, (exceedingly important).

Figure 3.

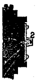


Fig. 3.

1. A hard rubber mouth-piece, into which the vocal or other sounds are thrown.

2. A cushion of rubber tubing, placed across the orifice in the mouth-piece, so that by screwing the mouth-piece into its frame, a pressure of this cushion is had upon the inside of the diaphragm, thus enabling any desired tension to be obtained upon the diaphragm—the end to be obtained being more perfect articulation, and a more natural tone.

Fig. 4.

A funnel for increasing the volume of sound in the reproduction.

INSTRUCTIONS FOR OPERATING.

1st. *To put the Foil on.*

Keep the foil perfectly free from kinks, draw it firmly around the cylinder, so that when fastened it is perfectly smooth and free from buckles or looseness in every part. Let the under edge pass over the slot just reaching the opposite edge, but not passing it, press the wedge into the slot with the ends of the fingers, deep enough to prevent the stylus from touching it.

2. *The Dampener.* (Fig. 3.)

To dampen the vibrations of the diaphragm, turn the mouth-piece to the right. This causes the rubber tubing to put an increased tension upon the plate. The most ready means of determining the proper tension is to sound a strong note into the mouth-piece while holding the finger lightly on the stylus. When the tension is slack the stylus will prick the finger very decidedly. Keep turning the mouth-piece to the right by small degrees, until the movement of the stylus is perceptibly diminished. It is then ready for use. If it is found upon trial to be dampened too much, it may be readily adjusted to the proper tension by experimenting with the voice.

3. *The Stylus Adjustment.* (Fig. 2.)

The first thing to do in adjusting the stylus is to turn the regulating screw (Fig. 1, No. 13) to the right, enough to prevent the stylus from touching the foil, when the mouth-piece is pressed forward into position; then turn the regulating screw to the left gradually, until it describes a slight line on the foil. Now see to the adjustment of the stylus *into the centre of the grooves* upon the cylinder. To do this, take the pointed iron pin (called a "centre pin"), press the pointed end upon the line described by the stylus. The centre pin will cause the foil to be depressed into the groove nearest the line. You will then be able to see how near the stylus is to its proper position. If too far to the left, take the blunt end of the centre pin and turn the centre screws (Fig. 1, No. 12) to the right gradually, until the line made by the stylus passes directly through the centre of that made by the centre pin, taking care always to keep sufficient tension upon the upright arm, by tightening the centre screws, to enable it to just support the weight of the upright at any angle it may be placed. This is to prevent any side movement of the stylus. Now, the regulating screw may be turned to the left until a groove is made of the proper depth, which is always shown by the sheet of record foil accompanying the instrument; say about 1-32 of an inch deep.

Care must be observed in *locking the upright* into position. It should always be locked *very rigidly* to prevent the mouth-piece from being forced forward when the lips press upon it in speaking, and to ensure its going sufficiently forward at all times to cause the stylus to make the proper depth of groove.

This locking cam (Fig. 1, No. 14) has two adjustments. It is itself a screw, and may be turned further in or out, as may be required to bring the steel lips into the angle slots; and the slots themselves being made at an angle, impose a grip upon the lips as they are pressed into them.

In effecting the adjustment of the stylus, as well also as at all times when using the instrument, observe carefully this

CAUTION:

Never turn the instrument backward, or permit it to drop backward slightly, by checking its momentum with the handle. The surest means of preventing this is to invariably stop the instrument, by placing the hand upon the balance wheel instead of the handle.

Never remove the carrying nut from the shaft thread until the stylus has been withdrawn from the foil; otherwise, the stylus is drawn *across* the grooves and is liable to be broken.

4. *The Movement of the Cylinder.*

The best average rate of speed at which to rotate the cylinder is about sixty revolutions per minute. To reproduce the sounds in as near as possible their original tone, precisely the same speed must be had in the reproduction as in the recording. A uniform speed is very important, especially in the reproduction of all musical tones.

The reversal of the cylinder is effected by releasing the carrying nut (Fig. 1, No. 10), and slipping the shaft to the right, through the smooth bearings, all the while keeping up a *forward* rotation of the cylinder. This maintenance of the rotary movement of the cylinder while the nut is being forced *into* or *withdrawn* from the thread, is important to facilitate the operation of the nut, and to prevent the nut from being locked *on top of the thread* instead of into it.

5. *To effect the best Record.*

To speak to the instrument with the greatest effect, the lips should be placed as far into the mouth-piece as possible, consistent with a clear and distinct utterance of the words. The best tones are the deep, strong chest tones. The best in *quality* is the fine soprano of a lady or child.

6. *Reproduction of the Sounds.*

To reproduce any sounds which have been recorded, return the stylus to the original starting point, by moving the cylinder to

the right, as provided in Article 4. Lock the stylus again in position, place the funnel (Fig. 4) on the mouth-piece, and rotate the cylinder precisely as when making the record.

7. *Renewal, fixing and shape of Stylus.*

This is by far the most important of all the details of the Phonograph. The volume of sound and the perfection of the articulation depend almost wholly on the shape and position of the stylus.

Fig. 2, shows the proper position. The diaphragm, No. 1, should be perfectly flat and free from buckles.

The stylus, No. 2, should be shaped as shown in the drawing, like a chisel with a short bevel, the bevel resting upon the foil parallel with the cylinder.

No. 3, a rubber cushion made of tubing about one-quarter of an inch long. The steel spring, (No. 4), which holds the stylus, should be clamped in the holder, so as to permit the top of it to just reach the centre of the cushion, which cushion is placed exactly in the centre of the plate; this brings the stylus itself, a trifle, say one-sixteenth of an inch *below the centre* of the plate, which has proven to be the most effective position. In cementing this cushion to the plate, and the spring to the cushion, great care must be had to obtain *solidity of contact.* The best method is to place a small piece of wax about half the size of a pea, on the plate, touch it with a heated screw-driver or small flat piece of metal, holding the cushion on with the thumb lightly at first, until the wax has melted and run under the cushion, then putting some pressure on it and causing the remaining wax to form a little bridge between the cushion and the plate, (avoid getting the wax on the upper section of the cushion, as it must have a certain degree of elasticity across its centre), hold the cushion down until the wax has cooled, then repeat the operation on the other side of the cushion. It will be found more convenient to do this by taking the mouth-piece from the upright, and laying it on the table. When the cushion has been thus placed it should be *flat on the bottom.*

To fasten the spring to the cushion, take a piece of wax about one-sixteenth of an inch in diameter, insert it between the spring and the cushion, and hold the heated metal piece on the top end of the spring until the wax has thoroughly melted, pressing it down firmly all the while—as soon as the wax is thoroughly melted, substitute a cool piece for the heated piece, to hold it down until the wax

has thoroughly set, then press the spring down hard with the finger, three or four times, to restore elasticity to the cushion, taking care not to loosen the spring from the cushion, or the cushion from the diaphragm.

If at any time the instrument appears to be less effective than usual, examine the cement between the spring and the cushion, and if not very firmly held, reset it, and, nine times out of ten, the result will be beneficial.

It has been thought well to be thus explicit and elaborate in these instructions, because of the fact that few have ever seen the Phonograph, and have no data by which to judge as to whether or no they obtain the full capacity of the instrument. If these instructions are carefully followed, the most perfect novice will be able to obtain the full capabilities of the Phonograph.

A good strong voice and a distinct utterance are the requisite qualifications of a good operator.

The Edison Speaking Phonograph Co.

66 READE STREET, NEW YORK.

E. H. JOHNSON, *Secretary.*

(Form 503.)

EDISON'S SPEAKING PHONOGRAPH.

INSTRUCTIONS

FOR

Operating Experimental Apparatus.

PRECAUTIONS.

Do not move the cylinder while the arm is in position until the conditions are right for the proper action of the embossing point upon the foil. Do not lock the arm in position unless the foil is upon the cylinder.

Always withdraw the arm to run the cylinder back to the starting point.

In operating the machine always begin from $\frac{1}{4}$ to $\frac{1}{2}$ inch from the edge of the foil; if too close, or off the edge, the point is apt to catch and tear the foil, or wedge itself sidewise and out of center. Do not set the point so deep as to tear the foil.

Handle the point with care to prevent its becoming detached from the rubber cushion, or the cushion from the diaphragm.

TO PUT THE FOIL ON.

Gum one end to the depth of one-fourth inch with the gum furnished (shellac varnish), hold the gummed end between the thumb and forefinger of the left-hand at the back of the cylinder, with the gummed side toward the cylinder, slip the ungummed end under the cylinder, catching it between the thumb and forefinger of the right-hand and drawing it firmly up and around the cylinder. Then draw the gummed end forward, overlapping the ungummed end and pressing the two edges firmly together. Great care must be taken to get the foil on firmly around the cylinder and without creasing.

To adjust and center the embossing point run the cylinder to the right until the embossing point is near the left-hand edge, but not beyond it; then move the arm forward gently until the point rests upon the foil with sufficient pressure to leave a mark; then take the small iron centering-pin and press it on the mark forcing the foil into the groove of the cylinder, and observe if the embossed mark is exactly in the centre of the groove—if not, adjust the point to the right or left, as the case may be, by means of the small adjustable-screws at the base of the support carrying the mouth-piece. When thus adjusted to the center of the groove, the embossing point may be set to make any depth of groove desirable by means of the thumb-screw through the end of the arm. Usually the best depth of a groove is $\frac{1}{100}$ of an inch; that is to say, just sufficient to keep the point always making a groove in the foil, no matter how great the amplitude of the vibrations of the plate.

RATE OF SPEED OF TURNING CYLINDER.

The cylinder should be rotated at the same rate, when the words are being reproduced, as when they are spoken into the apparatus. Uniformity of speed is very essential, especially in producing a musical tone. The best rate is about 80 revolutions per minute.

TO MAKE THE RECORD.

To speak into the instrument with the best effect, the lips should be held gently against the mouth-piece and the gutteral or chest tones used rather than the less powerful roof tones. A little practice will show how to obtain the best effects.

TO REPRODUCE.

Withdraw the arm, then reverse the cylinder until the embossing point is a trifle beyond the original starting point. Then replace the arm and rotate the cylinder again.

To get a much greater volume of sound place a paper or metal funnel or horn on the mouth piece, the small end of such funnel should be a trifle larger than the opening in the mouth-piece, in order to prevent it from slipping through and thus resting on the diaphragm.

The record may be reproduced a number of times.

THE EMBOSSING POINT.

This is made of the point of a No. 9 sewing-needle slightly flattened on two sides by rubbing on an oil stone, the sharp edges being taken off by gently touching them on the stone; as the character of the articulation, however, depends very much upon the proper shape of this point, we prefer to supply them and will keep them constantly on hand.

THE RUBBER CUSHIONS.

The object of these cushions is to dampen the vibrations of the diaphragm: that between the embossing point and the diaphragm is fastened to both by means of ordinary sealing-wax; and should it become loose, it may readily be fastened by heating the head of a small nail and holding that a moment against the spring or diaphragm until the wax melts, then remove the nail, still holding the spring or diaphragm against the cushion until the wax sets.

The small bits of rubber tube placed between the edge of the mouth-piece and the diaphragm should be occasionally renewed, as they get set and lose their elasticity. In putting them in care must be taken not to injure the diaphragm by over-great pressure or indenting it with the knife-blade or other pointed instrument used in inserting them.

SUGGESTIONS FOR EXPERIMENTS.

Recite at first in a strong voice familiar nursery rhymes, conversational sentences, etc., then as the ear becomes more familiar with the peculiar character of the sounds, indulge in more pretentious recitations.

Vary the tone of voice in all ways. Change the tone to a higher or lower key in reproducing by rotating the cylinder faster or slower.

Hold the nose when speaking and get a nasal twang.

Imitate every species of animal, crow like a cock, cackle like a hen, squeal like a hog, etc., etc., etc. Imitate every species of sound known. Sing songs, airs, duets (in the funnel). Play the cornet or other similar instrument, etc., etc.

All music should be quick movement, as without clock-work sufficient uniformity of speed is not obtainable to produce properly a sustained note.

THE EDISON SPEAKING PHONOGRAPH CO.

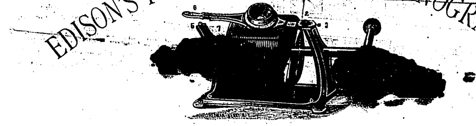
E. H. JOHNSON, *Gen'l Agent.*

P. O. Box 5,529, New York.

THE GREATEST NOVELTY OF THE AGE.

PRICE ONLY $10.00.

EDISON'S PARLOR SPEAKING PHONOGRAPH.



INSTRUCTIONS.

Explanation of Figures in above Drawing.

1. Handle by which the shaft is turned both backward and forward.

2. A screw by which the arm holding the mouth-piece is made tight or loose.

3. A screw by which the arm is moved to right or left, in order [illegible] cylinder.

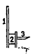
4. A slot [illegible] der to receive the two ends of the foil, and a steel a [illegible] rod or wedge, which is pressed in on the foil to hold it [illegible]

5. A screw which, as it is lowered or raised, will lift the pen up from the cylinder groove or lower it, in order to give it proper position.

6. A swinging arm which removes the mouth-piece from cylinder, to let it be run backward—when speaking upon the foil, this must be pressed gently down upon screw No. 5.

7. A ring of brass, which acts as a guide for the tin foil, so that the records can be reproduced at any future time.

Figure 2.



2.

1. Diaphragm of mica—a thin plate which vibrates in unison with the voice, or other sounds thrown upon it.

2. A cushion, the function of wh [illegible] estroy the too metallic sound which [illegible] metallic contract between the stylus and plate [illegible]

3. A stylus or needle-point for recording the movements of the diaphragm upon the foil, and for re-traversing the record thus made, and giving back to the diaphragm its original vibratory movement, and consequently reproducing the sounds.

4. A spring to hold the stylus rigidly in position.

Fig. 3.

A funnel for increasing the volume of sound in the reproduction.

INSTRUCTIONS FOR OPERATING.

1st. *To put the Foil on.*

Keep the foil perfectly free from kinks, draw it firmly around the cylinder, so that when fastened it is perfectly smooth and free from buckles or looseness in every part. Let the under end pass [illegible] The other end is now lapped over it, [illegible] are pressed down into the slot by the rubber covered steel rod; this must be pressed so deep in the slot with the ends of the fingers, that the needle will not touch it when working. One side of the tin foil should always touch the brass ring on the left hand end of cylinder, so that if the recorded tin foil sheet is put on another instrument, it will reproduce it equally as well as on the instrument that made it.

2d. *The Stylus Adjustment.*

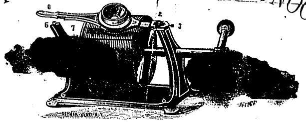
The first thi [illegible] sting the stylus, is to turn the regulating scre [illegible] nough to prevent the stylus from touc [illegible] is pressed down into position, [illegible] until a slight line is described [illegible] see to the adjustment of the stylus *into the centre of the grooves* upon the cylinder. To do this, take the pointed iron pin, (called a "centre pin") press the pointed end upon the line described by the stylus. The centre pin will cause the foil to be depressed into the groove nearest the line; you will then be able to see how near the stylus is to its proper position.

If, too far to the left, turn the adjusting screw 3, Fig. 1 to the right, gradually, until the line made by the stylus passes directly through the centre of that made by the centre pin. If, on the contrary, it is too far to the right, the screw 2, Fig. 1, must be loosened, and the screw 3, Fig. 1, also; this will allow the lever to be pushed back against screw 3. Screw 2 must now be made fast, and the stylus can be adjusted to centre of groove by turning screw 3 to the right in the same manner as before.

THE GREATEST NOVELTY OF THE AGE.

PRICE ONLY $10.00.

EDISON'S PARLOR SPEAKING PHONOGRAPH.



INSTRUCTIONS.

Explanation of Figures in above Drawing.

1. Handle by which the shaft is turned both backward and forward.

2. A screw by which the arm holding the mouth-piece is made tight or loose.

3. A screw by which the arm is moved to right or left, in order [illegible] cylinder.

4. A slot [illegible] der to receive the two ends of the foil, and a steel a[illegible] rod or wedge, which is pressed in on the foil to hold it.

5. A screw which, as it is lowered or raised, will lift the pen up from the cylinder groove or lower it, in order to give it proper position.

6. A swinging arm which removes the mouth-piece from cylinder, to let it be run backward—when speaking upon the foil, this must be pressed gently down upon screw No. 5.

7. A ring of brass, which acts as a guide for the tin foil, so that the records can be reproduced at any future time.

Figure 2.

1. Diaphragm of mica—a thin plate which vibrates in unison with the voice, or other sounds thrown upon it.

2. A cushion, the function of wh[illegible]estroy the too metallic sound which[illegible] metallic contract between the stylus and plate.

3. A stylus or needle-point for recording the movements of the diaphragm upon the foil, and for retraversing the record thus made, and giving back to the diaphragm its original vibratory movement, and consequently reproducing the sounds.

4. A spring to hold the stylus rigidly in position.

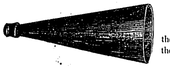


Fig. 3.

A funnel for increasing the volume of sound in the reproduction.

INSTRUCTIONS FOR OPERATING.

1st. *To put the Foil on.*

Keep the foil perfectly free from kinks, draw it firmly around the cylinder, so that when fastened it is perfectly smooth and free from buckles or looseness in every part. Let the under end pass [illegible] The other end is now lapped over it, [illegible] are pressed down into the slot by the rubber covered steel rod; this must be pressed so deep in the slot with the ends of the fingers, that the needle will not touch it when working. One side of the tin foil should always touch the brass ring on the left hand end of cylinder, so that if the recorded tin foil sheet is put on another instrument, it will reproduce it equally as well as on the instrument that made it.

2d. *The Stylus Adjustment.*

The first thing [illegible]usting the stylus, is to turn the regulating scre[illegible] nough to prevent the stylus from touc[illegible] piece is pressed down into position [illegible] until a slight line is described [illegible] see to the adjustment of the stylus *into the centre of the grooves* upon the cylinder. To do this, take the pointed iron pin, (called a "centre pin") press the pointed end upon the line described by the stylus. The centre pin will cause the foil to be depressed into the groove nearest the line; you will then be able to see how near the stylus is to its proper position.

If too far to the left, turn the adjusting screw 3, Fig. 1 to the right, gradually, until the line made by the stylus passes directly through the centre of that made by the centre pin. If, on the contrary, it is too far to the right, the screw 2, Fig. 1, must be loosened, and the screw 3, Fig. 1, also; this will allow the lever to be pushed back against screw 3. Screw 2 must now be made fast, and the stylus can be adjusted to centre of groove by turning screw 3 to the right in the same manner as before.

In effecting the adjustment of the stylus, as well also as at all times when using the instrument, observe carefully this

CAUTION:

Never turn the instrument backward, or permit it to drop backward slightly, by checking its momentum with the handle. The surest means of preventing this is to invariably take the pressure off the lever, and let it spring up before you stop turning.

3d. *The Movement of the Cylinder.*

The best average rate of speed is about sixty revolutions per minute. To reproduce the sounds in as near as possible their original tone, precisely the same speed must be had in the reproduction as in the recording.

4th. *To effect the best Record* [illegible]

To speak to the instrument [illegible] effect, the lips should be placed as far into the mouth-piece [illegible] possible, consistent with a clear and distinct utterance of the words. The best tones are the deep, strong chest tones. The best in *quality* are the fine soprano of a lady or child.

5th. *Reproduction of the Sounds.*

To reproduce any sounds which have been recorded, return the cylinder to the original starting point, (first allowing the stylus to spring up, so that it will not be injured when the cylinder is turned back) press the stylus again in position, and holding the funnel Fig. 3 on the mouth-piece, rotate the cylinder precisely as when making the record.

6th. *Renewal, fixing and shape of Stylus.*

[illegible] depend almost wh[illegible] the shape and position of the stylus.

Fig. 2, shows the proper position. The diaphragm, No. 1, should be perfectly flat and free from buckles.

The stylus, No. 3, should be shaped as shown in the drawing, like a chisel with a short bevel, the bevel resting upon the foil parallel with the cylinder.

No. 2, a felt cushion. The spring, (No. 4), which holds the stylus, should be clamped in the holder, so as to permit the top of it to just reach the centre of the cushion, which cushion is placed exactly in the centre of the plate; this brings the stylus itself, a trifle, say one-sixteenth of an inch *below the centre* of the plate, which has proven to be the most effective position. In cementing this cushion to the plate, and the spring to the cushion, great care must be had to obtain *solidity of contact.* The best method is to place a small piece of wax about half the size of a pea, on the plate, touch it with a heated screw-driver or small flat piece of metal, holding the cushion on with the thumb lightly at first, until the wax has [illegible] and run under the cushion, then putting some [illegible] using the remaining wax to form a little bridg[illegible] cushion and the plate, (avoid getting the wax on the upper [illegible] of the cushion, as it must have a certain degree of elasticity across its centre), hold the cushion down until the wax has cooled, then repeat the operation on the other side of the cushion.

To fasten the spring to the cushion, take a piece of wax about one-sixteenth of an inch in diameter, insert it between the spring and the cushion, and hold the heated metal piece on the top end of the spring until the wax has thoroughly melted, pressing it down firmly all the while—as soon as the wax is thoroughly melted, substitute a cool piece for the heated piece, to hold it down until the wax has thoroughly set, then press the spring down hard with the finger, three or four times, to restore elasticity to the cushion, taking care not to loosen the spring from the cushion, or the cushion from the diaphragm.

[illegible] effective than usual, examine the cement between [illegible] the cushion, and if not very firmly held, reset it.

If these instructions are carefully followed, the most perfect novice will be able to obtain the full capabilities of the Phonograph.

A good strong voice and a distinct utterance are the requisite qualifications of a good operator.

The adaptation of this wonderful discovery to the practical uses of commerce and social life not having, as yet, been completed, in all its mechanical details, this company is now prepared to offer to the public only that design or form of apparatus which has been found best adapted to its exhibition as a novelty.

THE "PARLOR SP[illegible]APH" is intended for use in the parlor or drawing room, and will hold 150 to 200 words. The cylinder is s[illegible] taken off and replaced at any future time, thereby reproducing the same sounds that have been impr[illegible]gh to be heard in any ordinary room. We have a limited number now ready which we will sell for $10 cash, [illegible]th all needed applia[illegible] for use.

Our Priced and Illustrated Catalogue will be published in four parts, any or all of which will be mailed on application.

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Gen'l Manager.

Reception to Mr. Edison.

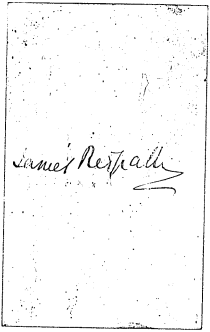
After the Concert at Irving Hall, on Monday Evening, June 3, at 10 p.m., a press reception will be given to MR. THOMAS A. EDISON.

You are respectfully invited to be our guest on that occasion.

MR. EDISON *will exhibit his Phonograph, explain his latest invention for measuring the heat of distant stars, etc.*

Supper at 11 p.m.

This Card of Invitation will admit the bearer.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Charming Soprano Solos.

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Illustrations of Sound Motion as applied to the Phonograph.

Solos, Duets, Recitations, Whistling, Etc., on

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Every Evening and Wednesday and Saturday Matinees

Admission, - 25 Cents,

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PROGRAMME.

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1. ORGAN—"Wedding March," . . . *Mendelssohn*
   Mr. G. W. MORGAN.
2. SONG—"Let me Dream again," . . . *Sullivan*
   Mme. BELLE COLE.
3. ORGAN—Air Varied, Benedict's Ballad, "By the Sad Sea Waves," . . . *Morgan*
   Mr. G. W. MORGAN.
4. SONG—"She Wandered down the Mountain Side," . . . *Clay*
   Mme. BELLE COLE.
5. Explanatory Remarks on the **Telephone** and **Phonograph.**
   Mr. E. H. JOHNSON.
6. Practical Demonstration of the **Edison Musical Telephone** and **Edison Speaking** and **Musical Phonograph,**

With Recitations, etc., etc., by . . . *Mr. E. H. JOHNSON*

Soprano Solos, by . . . *Mme. BELLE COLE*

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Duets, Whistling, etc., etc.

The fine Organ used at these Exhibitions was built by Mr. HILBORNE L. ROOSEVELT for St Paul's Episcopal Church (the first Protestant Church) in Rome, Italy, and temporarily erected in this Hall by him for the purpose of aiding the Organ Fund of that Church.

☞ Mr. GEORGE W. MORGAN has been engaged to play Every Night and Wednesday and Saturday Matinees of this week.

The Phonograph used at these Exhibitions embodies the latest improvements made by Mr. EDISON, and clearly demonstrates that under his wonderfully fertile brain and persistent energy this—his most marvelous invention—is rapidly approaching perfection in all its detail, thus substantiating the claim that human speech may henceforth be permanently retained.

PROGRAMME.

Saturday Evening, June 22d, 1878.

1. ORGAN—Overture, "Fidelio," . . . *Beethoven*
   Mr. G. W. MORGAN.
2. SONG—"Waiting," . . . *Millard*
   Mme. BELLE COLE.
3. ORGAN—"Fantasie," . . . *Morgan*
   Mr. G. W. MORGAN.
4. SONG—"L'Arditi Waltz," . . . *Arditi*
   Mme. BELLE COLE.
5. Illustrated Lecture on **Sound-Motion.**
   Prof. ROBERT SPICE.
6. Explanatory Remarks on the **Telephone** and **Phonograph.**
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LOS INVENTOS

DEL SEÑOR DON

TOMAS A. EDISON.

El Fonógrafo,

(ó máquina que habla.)

El invento mas sublime de este siglo; una máquina que reproduce palabras, el canto, el sonido de la corneta, etc. Cuando una vez el sonido está depositado en ella, éste puede repetirse un número ilimitado de veces y centenares de años mas adelante.

El Teléfono.

Uno de los adelantos mas admirables del tiempo moderno. Se puede trasmitir mediante esta máquina la palabra que se habla á la distancia de 500 millas; ella ocupa, pues el lugar del Telégrafo y puede usarse por cualquiera persona sin preparacion alguna.

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Este invento, verdaderamente milagroso, hace oir á las personas las palabras que se han hablado, ó la música que se ha tocado en cualquier lugar de un cuarto que diste 30 millas. Cuando este instrumento se usa no hay secreto posible, pues el ruido mas insignificante en un cuarto se trasmite inmediatamente.

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Music sent by telegraph over the wires, and distinctly heard by the entire audience at once.

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This marvelously delicate apparatus for making audible sounds which are otherwise inaudible, and in connection with the Telephone, transmitting them to a distance, is exhibited in a practical manner and Mr. Edison's claim of priority of discovery clearly set forth and sustained.

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It is just long enough to be sung into one sheet of tin-foil and is admirably reproduced.

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Orders will be filled C. O. D. *unless accompanied by draft, or postal money order.*

Do not enclose any money in letters.

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G. SCHIRMER,
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This is a good song and quite effective.

Its Introduction will be an excellent feature.

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1. "List of Subscribers . . . San Francisco, August 16, 1879"
2. "List of Subscribers . . . San Francisco, October 15, 1879"
3. "List of Subscribers . . . [Dayton, Ohio] November 1, 1879"

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*ALAMEDA B. & L. ASS'N	Moritz Friedrich, Sec'ry	309 California.
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*ALLEN, C. R	Coal	120 Beale.
*ALLEN & LEWIS	Commission Merchants	202 California.
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*AYER, WASHINGTON	Physician	1622 Clay.
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*BADLAM, A	Residence	708 California.
*BAKER & HAMILTON	Hardware	7-19 Front
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*BARNES, COL. W. H. L	Attorney at Law	426 California.
*BARRON, EDWARD	Residence	413 Hyde.
BARNEY, GEN'L B. G	Residence	2209 Jackson.
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*BAZAN, F	Residence	1633 Mission.
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Berry, Gid. M	Residence	1728 Tyler.
*Biggs, A. R	Saloon	Pine and Sansome.
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*California Cracker Co	Bakers	206 and 208 Sacramento.
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*Cal. Dry Dock Co	Office	318 California.
*Cal. Dry Dock Co	Floating Docks	Spear and Bryant.
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*Cal. Furniture Co	Furniture	649 Market.
*California Paint Co	Paints	329 Market.
*California Paint Co	Paints	27 Stevenson.
*Cal. Silk Man'f'g Co	Robt. Morrison	Cor. P. & 11th Av., South S. F.
*California St. R. R. Co		Cal. and Cemetery Ave.
*California St. R. R. Co		California and Larkin.
*California St. R. R. Co		California and Kearny.
*Cal. Wire Works Co	Wire	6 California.
*Campbell, J. B	Post Commander	Black Point.
*Campi's Restaurant	N. Giamboni & Co	533 Clay.

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NAME.	BUSINESS.	LOCATION.
*Carr, J. S. & Co	Wholesale Jobbing Grocers	600 and 602 Front.
*Centennial Planing Mills	W. B. Bradbury	556, 572 Brannan.
*Central Pacific R. R. Co	General Offices	Fourth and Townsend.
*Central Drug Store	Abramson & Bacon	Sutter & Dupont
*Chadbourne & Co	Furniture Dealers	735 Market.
*Chicago Brewery	H. H. Ahrens	1420 Pine.
*Chief of Police	Old City Hall	Kearny Street
*Chismore, Geo	Physician	920 Market.
*Christy & Wise	Wool	607 Front.
Chy Lung & Co	Chinese Merchants	521 Kearny.
Chy Lung & Co	Chinese Merchants	640 Sacramento.
*Clayton, Chas	Grain Dealer	400 Front.
*Club Stables	C. S. Crittenden	Taylor Street.
*Code, Elfelt & Co	Packing and Canning	125 Main.
*Code, Elfelt & Co	Packing and Canning	314 Washington.
*Coey, Gen. James	Postmaster	30 Twelfth.
*Coffin & Mayhew	Druggists	Mission and 20th.
*Cole, R. Beverly	Physician	518 Sutter.
*Coleman, Wm. T. & Co	Shipping and Commission	California and Front.
*Coleman, Evan J	Prest. Pac. Transfer Co	618 Harrison.
*Collins, S. P. & Co	Saloon	329 Montgomery.
*Conro, F. D. & Son	Golden Age Flouring Mills	717 to 721 Battery.
*Continental Oil and Transportation Co. of Cal		120 Front.
*Continental Oil and Transportation Co. of Cal		Warehouse, Berry and 5th.
*Cook, H. N	Manf'r Leath'r Belt'g & Hose	415 Market.
*Cook & Ellis	Manf's Leath'r Belt'g & Hose	37 Fremont.
*Cosmopolitan Hotel		Bush and Sansome.
*County Clerks Office		Old City Hall.
*County Clerks Office		New City Hall.
*County Hospital		Potrero Ave. bet. 22d & 23d.
*Corporation Yard	Fire Department	50 Sacramento.
*Cox, J. W. & Co	Cunningham's Warehouse	Green and Front.
*Cox, J. W. & Co	North P. D. F. Warehouse	Foot of Sansome.
*Cox, J. W. & Co	Humboldt Whf. Warehouse	Spear, bet. Fol. & Harrison.
*Crane & Brigham	Druggists	520 Market.
*Crittenden, C. S	Club Stables	Taylor Street.
*Crittenden, C. S	Office	311 Bush.
*Crocker, H. S. & Co	Stationers and Printers	Sansome and Sacramento.
*Crosett & Co	Employment Agency	230 Sutter.
*Cunningham's Warehouse	J. W. Cox & Co	Green and Front.
*Cutting & Co	Packing and Canning	17 Main.
*Daily Stock Report	Publishers	S. F. Stock Exchange B'ldg.
*Danforth, E	Broadway Bon'd Warehouse	Broadway and Battery.
*Danforth E.	Residence	1200 Mason St.
*Davis Bros	Golden Rule Bazaar	419 Kearny.
*Davis Bros	Golden Rule Bazaar	718 Market.
*Day, Thos	Gasfitter	122 Sutter.
*Deane, C. T	Physician	321 Ellis Street.
*Degener, E	Residence	Eddy and Laguna.
*Deming, Palmer & Co	Flour Mills	202 Davis.

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NAME.	BUSINESS.	LOCATION.
*Dewey & Co.	Publishers	202 Sansome.
*Dewey & Co	Publishers	414 Clay.
*DeYoung, Chas. & Co	S. F. Chronicle	506 Montgomery.
*DeYoung, Chas. & Co	S. F. Chronicle	423 Clay.
*DeYoung, Chas. & M. H	Residence	317 Eddy.
*Dodge, W. W. & Co	Grocers	401 Front.
*Dodge, Sweeney & Co	Wholesale Provisions	406 Front.
*Dolliver & Bro	Imp. Leather & Shoe Find'gs	107 Post.
*Donahue, Peter	Capitalist	426 Montgomery.
*Dorr L. L	Physician, 118 Dupont	Res. Mission & 20th
*Douglass, Wm. A	Physician	126 O'Farrell.
*Dunham, Carrigan & Co	Hardware, Iron, Steel, etc.	107 Front.
*Dunphy & Hildreth	Butchers	533 Kearny.
*Dunphy & Hildreth	Butchers	Butchertown.
*Dunphy, Wm	Residence	111 Mason.
*Durkee, J. L	Fire Marshal	Old City Hall.
*Dutard, H	Commission Merchant	217 and 219 Clay.
Earle, H. H	Residence	2222 Jackson.
*Eckel, J. N	Physician	324 Geary.
*Edwards, Pickens & Fulton	The Commercial Agency	401 Cal.
*Egan, John	Commanding Post	Fort Point.
*Einstein Bros & Co	Boots & Shoes	29 & 31 Battery St.
*Einstein Bros. & Co	Boots & Shoes	115 & 117 Hayes St.
*Einstein, Z	Residence	1509 Gough.
*Eldridge, Oliver	Pres't Cal. Dry Dock Co.	318 California.
*Elfelt, A. B. & Co	Imp't'rs Cloth'ng and Gents Furnishing Goods.	108 and 110 Sansome.
Elliott, Mrs	Residence	1817 Eddy.
*Eureka Warehouse	A. J. Gove	Montgomery and Chestnut.
*Evening Post	Publishers	502 Montgomery.
*Evers, Henry	Noltings Billiard Saloon	801 Kearny.
*"Examiner"	Daily Paper	533 Washington.
*Evans, A	Druggist	Hayes and Laguna.
*Excelsior Stables	Lot. D. Slocum	921, 923, 925 Sutter.
Falkner, Bell & Co		430 California.
*Fashion Stables	McCord, Bridge & Co.	Ellis near Mason.
*Feigenbaum & Co	Fancy Goods	120 Sansome.
*Felton, C. N	Capitalist	402 Montgomery.
*Ferguson John	Saloon	304 California.
*Field, Stephen D	Electrician	2321 California.
*Fire Department	Chief Engineer's Office	Old City Hall.
*Fire Department		Corporation Yard.
*Fire Department	Engine No. 2	Bush, near Kearny.
*Fire Department	Engine No. 3	California, nr. Leavenworth.
*Fire Department	Engine No. 7	Valencia and Guerrero.
*Fire Department	Hose No. 2	Post and Fillmore.
*Fire Patrol	Station 1	Stevenson and Ecker.
*Fire Patrol	Station 2	Grove and Larkin.
*Flint, Peabody & Co	Office	408 California.
*Flint, Peabody & Co	Factory	Brannan and Seventh.
*Flood, Noah F	Attorney, Residence	1904 Laguna.

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NAME.	BUSINESS.	LOCATION.
*Floyd, T. W. & Co	Overland Warehouse	Townsend bet. 2d and 3d.
*Floyd, Capt. Richard S	Capitalist	415 First.
*Fort Point	Military Station.	
Foster, A. W	Residence	1213 Jones.
*Fountain Saloon	Wm. Hesse, Jr.	Sutter and Kearny.
*Fraser, E. J	Physician	221 Powell.
*French Mutual Benevolent Society		510 Jackson.
*French Hospital		Bryant and Sixth.
*Friedrich, Moritz	Commission Merchant	309 California.
*Fulton Iron Works	Hinckley, Spiers & Hayes	207-213 Fremont.
*Funcke & Co	Tanners	9th St. near Brannan.
*Galli & Co	Fruit and Commission	516 Sansome.
*Gamble, James	Genl. Supt. W. U. T. Co.	302 Montgomery.
*Gambs, Fer'd	Liquor Dealer	305 California.
*Getleson & Landis	Leather and Findings	543 Market.
*Ghiradelli & Danzel	Coffee and Spice	415 Jackson.
*Giamboni, N. & Co	Campi's Restaurant	533 Clay.
*Gibbs, Geo. W. & Co	Iron, Steel & Blacksm's Tools	33-39 Fremont.
*Gibbs, W. C	Sec'y Cal. Dry Dock Co.	318 California.
*Gilbert & Moore	Furniture	219 Bush.
*Gilbert & Moore	Furniture	556 Brannan.
*Gladding, McBean & Co	Drain and Sewer Pipe	213 Market.
*Gladding, McBean & Co	Drain and Sewer Pipe	1312 Market.
*Glover & Willcomb	Curled Hair Manufacturers and Bedding Supplies.	65 & 67 New Montgomery.
*Goodyear Rubber Co		577 and 579 Market.
*Goodall, Perkins & Co	Steamship Agents	10 Market.
*Golden Age Flouring Mills	F. D. Conro & Son	717 to 721 Battery.
*Golden Rule Bazaar	Davis Bros	718 Market and 419 Kearny.
*Gove, A. J	Eureka Warehouse	Chestnut and Montgomery.
*Gradwohl, M. & Co	Butchers	1146 Market.
*Grangers' Business Ass'n		106 Davis.
*Gray, N. & Co	Undertakers	641 Sacramento.
*Greathouse & Blanding	Attorneys	324 Pine.
Greenwood, M	Treasurer G. & S. Tel. Co.	713 Hayes.
*Gregory, H. P. & Co	Pac. Machinery Depot	2 and 4 California.
*Grisar, E	Wool Warehouse	Fifth and Townsend.
*Gruen & Vogelsang	Saloon	215 Third.
*Gruen & Vogelsang	Saloon	142 Fourth.
*Gwin, Hon. Wm. M	Residence	618 Harrison.
*Haggin, J. B	Attorney	51 Nevada Block.
*Haggin, J. B	Capitalist	1250 Taylor.
*Hallidie, A. S	Salesroom and Office	6 California.
*Hallidie, A. S	Wire & Wire Rope Manuf'y	Vallejo and Sansome.
*Hallidie, A. S	Residence	1026 Washington.
*Hall, Edward F. Jr	Residence	915 Leavenworth.
*Hale, Wm. F	Physician	520 Kearny.
*Hale, W. F	Physician	Residence 516 Taylor.
*Hanscom, W. W	Hope Iron Works	Potrero.
*Hansen, C. R. & Co	Employment Agency	624 and 626 Clay.

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NAME.	BUSINESS.	LOCATION.
*Hasbrouck, H. C.	Commanding Post	Presidio.
*Haste & Kirk	Coal and Iron	21 Beale.
*Hathaway, E. V.	Rincon Pt. U.S. Bn'd War'se.	Spear and Bryant.
*Hathaway's U. S. Bonded Warehouse	E. V. Hathaway	Spear and Bryant.
*Hawley, Marcus C. & Co.	H'dw'e and Ag'lt'l Imp'm'ts.	Beale and Market.
*Hawley, Marcus C. & Co.	H'dw'e and Ag'lt'l Imp'm'ts.	Bluxome, bet. 4th and 5th.
*Hecht Bros. & Co.	Boots and Shoes	528 Market.
*Hecht, M. H.	Residence	1201 Van Ness Avenue.
*Health Office	City and County	124 Geary.
*Henderson, Jno. Jr.	Coal Dealer	117 O'Farrell.
*Heywood Bros. & Co.	Manufactures of Chairs	589, 591, 593 and 595 Mission cor. 2d.
*Hiester, A. C.	Stock Report	S. F. Stock Exchange B'ldg.
Higgins & Collins	Wood and Lumber	Beale St. Wharf.
Higgins & Collins	Wood and Lumber	East and Market.
*Hinckley, Spiers & Hayes	Fulton Iron Works	207-213 Fremont.
*Hirschfelder, Jos. O.	Physician	1326 Geary.
*Hobart, Wood & Co.	Boots and Shoes	15 Sansome.
*Hobbs, Pomeroy & Co.	Box Factory	11 and 13 Beale.
*Hobbs, Carlton	Residence	Liberty St.
*Hochkofler, R.	Merchandise Broker	205 Front.
Hochstadter, E.	Residence	320 Geary.
Hoffman, Southard		U. S. Court Building.
*Hoin, P. P. Jr.	Supt. Carrier's Dept. P. O.	1332 Sacramento.
*Holabird, S. B.	Chief Quartermaster	Presidio.
*Holbrook, Merrill & Stetson	Stoves, Metals & Tinware	113 California St.
*Holbrook, Merrill & Stetson	Warehouse	Battery & Commerce.
*Hope Iron Works	W. W. Hanscom	Potrero.
*Hopkins, W. S.	Residence	1422 California.
*House of Correction		Old San Jose Road.
*Howland, R. S.	Commission Merchant	206 Front.
*Hubbard, H. H.	Physician	22 Geary.
*Hudson, H. C.	Mustard and Spice Mill	124 Main.
*Hue, Kai & Co	Shoe Manufacturers	127 Clay.
Hueter Bros. & Co.	Pioneer Varnish Works	12 Second.
Hueter Bros. & Co.	Pioneer Varnish Works	Kansas and 24th.
*Hume, R. D. & Co.	Salm'n P'k'rs & Com'n Mchts.	309 and 311 Sacramento.
*Huntington, Hopkins & Co.	Hardware, Iron, Steel, etc.	2 to 10 Bush.
*Hutchinson & Mann	Insurance Agency	N. E. Cor. Sansome and Cal.
*Hutchinson, F. W.	Residence	1620 Jackson.
*Hutchinson, Gen'l C. I.	Residence	922 Van Ness Ave.
*Howes, E. K. & Co.	Woodenware	122 Front.
*Howes, E. K. & Co.	Woodenware	37 Main.
*Humboldt Whf. Wareh'se	J. W. Cox & Co.	Spear, bet. Fol. & Harrison.
*Industrial School		Old San Jose Road.
*Ingerson, H. H.	Physician	323 Geary.
*Jackson, Byron	Agricultural Machine Works	Sixth and Bluxome.
*Jennings, John	Hooper's South End Wareh's.	Japan and Townsend.
*Jory Bros	Wholes'e Manufs. Fine Shoes	S. W. cor. V. Ness Av & Fell.
*Journal of Commerce	Publishers	Clay and Sansome.

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NAME.	BUSINESS.	LOCATION.
*Justice Mining Co	J. P. Cavallier, Sec'y	419 California.
*Kaplin, Louis	Registrar of Voters	New City Hall.
*Kast & Co.	Fashionable Shoe Store	756 Market, cor. Dupont.
*Kearney, Peter A.	Druggist	501 Folsom.
*Keil, F. C.	Druggist	4th and Market.
*Kellogg & Carvell	Lombard Warehouse	Lombard and Sansome.
*Kelton, J. C.	Ass't Adj't General	Presidio.
*Kennedy, M. A.	Standard Theatre	Bush St.
*Keogh, John	Curled Hair and Upholstery Materials	73 and 75 New Mont.
*King of William, C. James & Co,	Manufacturers of Hermetically Sealed Goods.	Broadway and Sansome.
Kirkpatrick, Jno.	Chief of Police	331 Fell.
Kittle & Co.	Office	212 California.
*Knox, Geo. T.	Notary Public	444 California.
*Kullman, Wagner & Co.	Hides and Leather	45 Clay.
*Kullman, H.	Boot and Shoe Factory	Drumm and Washington.
*Ladd, Geo. S.	Prest. G. and S. Tel. Co	222 Sansome.
*Ladd, Geo. S.	Prest. G. and S. Tel. Co	515 Van Ness.
*Lake & McKoon	Attorneys	310 Pine.
Lane, Dr. L. C.	Physician	652 Mission.
Lane, Dr. L. C.	Physician	Clay and Buchanan.
*Langley & Co., Chas.	Druggists	Front and Pine.
*Laven, Col. J. A.		30 Sacramento.
*Lavenson & Winter	Bay Soap and Candle Works	South San Francisco.
*Lavery, J. V.	Supt. North Point Dock Grain Warehouse	Sansome & Chestnut.
*Lebenbaum L. & Co.	Grocers	529 Kearny.
*Lebenbaum, Goldberg & Co.	Grocers	California and Polk.
*Leipnitz & Co.	Druggists	236 Sutter.
Lemos Shirt Factory	L. Lemos, Prop'r	1007 Stockton.
Lemos Shirt Factory	L. Lemos, Prop'r	613 Kearny.
*Levy, S. W.	Boots and Shoes	115 and 117 Hayes.
*Levy, S. W.	Boots and Shoes	29 and 31 Battery.
*Lewitt, Wm.	Physician	Office & Res. 16 Turk.
*Lick House	Geo. Schoenwald, Manager	Mont. and Sutter.
*Lick Trust		606 Montgomery.
*Lloyd & Newlands	Attorneys	13 Nevada Block.
*Lombard Warehouse	Kellogg & Carvell	Lombard and Sansome.
*Loomis, Geo.	Plaza Stores	706 to 716 Kearny.
*Loomis, Geo.	Residence	Palace Hotel.
*Low, C. Adolphe & Co.	Gen'l Commission Merch'nts.	208 California.
*Lowry & Co.	Commission Merchants	Clay & Davis.
*Lusk, A. & Co.	Wholesale Fruit Dealers	534 and 536 Clay.
*McAllisters & Bergin	Attorneys	38 Nevada Block.
*Macdonough, J.	Coal	25 Market.
*Macdonough, J.	Coal	121 Folsom.
*Macondray & Co.	Shipping and Commission	204 Sansome.
*Madison & Burke	Real Estate Agents	501 Montgomery.
*Madison, J. H.	Residence	206 Stockton.
*Marriott, F.	Publisher	609 Merchant.

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NAME.	BUSINESS.	LOCATION.
*Marriott, F.	Publisher	2307 Jones.
*Marshall, Benjamin	Physician	S. W. cor. 21st & Valencia.
*Mastick, Belcher & Mastick	Attorneys	520 Montgomery.
*Maxwell, R. T.	Physician	135 Kearny.
*Mayhew, Earnest & Co.	Grain	302 Davis.
*McClung, J. W	Residence	1525 Sutter.
McComb, Gen'l Jno	Editor, Alta	529 California.
*McCord, Bridge & Co	Fashion Stables	Ellis, near Mason.
*McCord, Bridge & Co	St. Lawrence Stables	212 Sutter St.
*McDonnell, J. J.	Druggist	6th and Market.
*McDowell, Irvin	Major-Gen'l Commanding	Black Point.
*McKenna & Greany	Commission Merchants	205 Drumm.
*McMenomy, J. H.	Butcher	California Market.
*McNear, G. W	Shipping and Commission	20 California.
*McNulty, J. M	Physician	118 Dupont Res. Palace H'l.
*McNutt, W. F.	Physician	808 Bush.
*Mechanics' Fair	Pavilion	Eighth and Mission.
*Medical College		Cor. Stockton & Francisco.
*Meese, Constant	Bay Sugar Refinery	14 Bernard Street.
Mendocino Lumber Co.	Lumber	Beale St. Wharf.
Mendocino Lumber Co.	Office	40 California.
*Merrill, P.	Cal. Carpet Beating and Hair Picking	453 Stevenson.
*Merry, Faull & Co	Provision Packers	415 Front.
*Merry, Faull & Co	Provision Packers	Black Point.
*Meyer, Capt. H. L. E.	Residence	N.W. cor. Webster & Clay.
*Meyers, R. C	Druggist	Powell and Union.
*Michelssen, Brown & Co.	Pork Packers	Foot of 9th.
*Michelssen, Brown & Co.	Butchers and Pork Packers	308 Front.
*Michelssen, Brown & Co.	Butchers	Butchertown.
*Middleton & Farnsworth	Coal	14 Post.
*Middleton & Farnsworth	Coal	718 Sansome.
*Miller & Eaton	Shipping and Commission	Jackson St. Wharf.
*Miller & Richard	Type Founders	529 Commercial.
*Mills, D. O	Capitalist	Over London & S. F. B'k.
*Mills, D. O.	Capitalist	Millbrae.
*Mining & Scientific Press	Dewey & Co	202 Sansome.
*Mining & Scientific Press	Dewey & Co.	414 Clay.
*Mission Bay Warehouse	Edward Bangs	Channel and 4th.
Molera, E. J	Residence	1928 Sacramento.
*Montague, W. W. & Co.	Stoves and Tinware	110 Battery.
*Moore, C. W	Physician	652 Market.
*Morning Call	Publishers	517 Clay.
*Morrow, Geo	Hay and Grain	37 Clay.
*Morrow, Wm. W	Chairman Republican State Central Committee	Nevada Block.
*Morse, H. N	Detective Agency	12 Safe Deposit.
*Morton, J. & Co.	Draymen	204 Battery.
*Morton, J. & Co	Stables	Ellis and Taylor.
*Mullan & Hyde	Land Agents	623 Commercial.

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NAME.	BUSINESS.	LOCATION.
*Murphy, Grant & Co	Wholesale Dry Goods	Bush and Sansome.
Murphy, James	Physician	1613 Van Ness Ave.
Murphy, James	Physician	659 Clay.
*Mutual Ice Co		357 Tehama.
*Myers, Gilman & Co.	Pacific Box Factory	515 Sacramento.
*Myers, Gilman & Co.	Pacific Box Factory	9th and Harrison.
*Naphtaly, Freidenrich & Ackerman	Attorneys	426 California.
*Neustadter Bros	Importers	Battery and Pine.
*Neustadter Bros	Standard Shirt Factory	Gough and Grove.
*Neustadter, David	Residence	1016 Sutter.
*New Constitution Party	Head Quarters	228 Montgomery.
*Newman, Carlton	Prop'r Glass Works	1585 Folsom.
*Newman, Carlton	Prop'r Glass Works	King Street.
*Newton Bros. & Co	Grocers	204 California.
*Newton, Morris	Residence	1026 Twenty-first.
*New York Life Ins. Co	Alex. G. Hawes, Agent	220 Sansome.
Nicoll	The Tailor	727 Market.
Nicoll	The Tailor	18 Kearny.
Nicoll	The Tailor	505 Montgomery.
*North Pt. Dk. Free Wareh'e.	J. W. Cox & Co	Foot Sansome St.
*N'th Pt. Dk. Grain Wareh'e.	J. V. Lavery, Supt.	Sansome & Chestnut.
*Nourse & Mitchell	Overland Frt. Transfer Co.	4th and King.
*Nutting, Calvin & Son	Pioneer Iron Works	121–123 Fremont.
*Occident Stables	A. Waters	Polk and Geary.
*Occidental Foundry	Steiger & Kerr	137 First.
*Occidental Grain Warehouse	Wm. M. Starr	First & Townsend.
*Occidental Hotel	Chas. L. Wetherbee, Manager	Montgomery and Bush.
*Odd Fellows Association	Odd Fellows Building	325 Montgomery.
*Odd Fellows Cemetery		Cemetery.
Oliver, Wm. Letts	Mining Secretary	Room 13, Safe Deposit Bldg.
*Olympic Club		119 Post.
*Opera Saloon	Weiss & Feldmann	327 Bush.
*Oriental Bonded Wareh'e.	Pool & Harris	Brannan and First.
*Overland Frt. Trans. Co.	C. P. R. R. Freight Dept	King Street.
*Overland Warehouse	T. W. Floyd & Co.	3d and Townsend.
*Pac. Barrel & Keg Factory	Flint, Peabody & Co	Brannan and Seventh.
*Pacific Coast Steamsh'p Co.		10 Market.
*Pacific Mail S. S. Co.	Dock	First and Brannan.
*Pacific Rolling Mills		16 First Street.
*Pacific Rolling Mills		Potrero.
*Pacific Box Factory	Myers, Gilman & Co	515 Sac. and 9th & Harrison.
Pacific Oil & Lead Works		King bet. 2d and 3d.
*Pacific Tannery	Kullman, Wagner & Co.	45 Clay.
*Pacific Transfer Co		110 Sutter.
*Pacific Transfer Co.	C. P. Baggage Office	Oakland Ferry.
*Pacific Vinegar Works	J. L. Koster.	415 Fulton.
*Pacific Vinegar Works	J. L. Koster	323 Front.
*Page, Moore & Co.	Commission Merchants	213 Clay.
*Painter, Emlen	Druggist	Clay and Kearny.
*Painter, Emlen	Druggist	11th and Mission.

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NAME.	BUSINESS.	LOCATION.
*Painter & Co	Electrotypers & Stereotypers	510 Clay.
*Palmer, Geo. H	Physician	424 Post.
*Patrick, A. B. & Co	Tanners	Eighteenth and Folsom.
*Pease, G. M	Physician	125 Turk.
*Pease, R. H. Jr	Agent Goodyear Rubber Co.	Residence 1401 Sutter.
*Pendergast & Smith	Ætna Iron Works	217 Fremont.
*Phillips, Capt. Wm. A		Folsom St. Wharf.
*Pest House		San Bruno Road.
*Pickering, L	Publisher	517 Clay.
*Pickering, L	Publisher	1018 Bush.
*Pioneer Iron Works	Calvin Nutting & Son	121-123 Fremont.
*Plum, Chas. M. & Co	Furniture and Carpets	641 Market.
Poheim, J	Tailor	203 Montgomery.
Poheim, J	Tailor	103 Third.
*Police Station	Chief of Police Office	Old City Hall.
*Police Station	Harbor Police	522 Davis.
*Police Station		Fifth and Clementina.
*Police Station		Howard and Seventeenth.
*Police Station		833 Sutter.
*Police Station		961 Mission.
*Police Station		247 Stewart.
*Police Station		New City Hall.
*Poly, Heilbron & Co	Butchers	339 Kearny.
*Poly, Heilbron & Co	Butchers	Butchertown.
*Pool & Harris	Oriental U.S. Bon'd Wareh'e.	Brannan and First.
*Porter, Oppenheimer, Slessinger & Co.,	Boots & Shoes.	117 Battery.
*Porter, Oppenheimer, Slessinger & Co.,	Boots & Shoes.	Clay and Sansome.
*Post Office	Central Office	Washington and Battery.
*Post Office	Station A	1305 Polk.
*Post Office	Station B	7th and Market.
*Post Office	Station C	20th and Mission.
Preston & McKinnon	Lumber Dealers	Pier 5, Stewart.
Preston & McKinnon	Lumber Derlers	Bryant and Main.
*Prescott, Scott & Co	Union Iron Works	First and Mission.
*Presidio	Military Reservation.	
*Prosek, J	Physician	Office, O'Farrell & Dupont.
*Prosek, J	Physician	Residence, 418 Van Ness.
Quong Yee	Chinese Merchant	828 Dupont.
Quong Yee	Chinese Merchant	408 Merchant.
Quong Yee	Chinese Merchant	410 Kearny.
*Raimond, R. E	Capitalist	1112 Stockton.
Reed, Geo. W	Residence	1527 Sutter.
*Redington & Co	Druggists	529 Market.
*Registration Office	Louis Kaplan	New City Hall.
*Renton Coal Co	Coal	28 Sacramento.
*Renton Coal Co	Coal	Sutter and Larkin.
*Republican State Central Committee,	Head Quarters.	Market and Third.
*Reynolds, Thos. H	County Clerk	Old City Hall.
*Reynolds, Thos. H	County Clerk	New City Hall.
*Reynolds, Thos. H	Residence	628 Washington.

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NAME.	BUSINESS.	LOCATION.
*Richter, C. Max	Physician	126 Kearny, Thurlow Block.
*Richter, C. Max	Physician	914 Post.
*Rider, Somers & Co	Hay and Grain	Pier 22 Stuart.
*Riley & Vest	Grain and Com'sion M'ch'ts	507 East.
*Rincon Point U. S. Bonded Warehouse,	E.V. Hathaway.	Spear and Bryant.
*Risdon Iron and Locomotive Works		Howard and Beale.
*Roche & Desbeck	Attorneys at Law	R'ms 30, 31 & 32 Mont. Blk.
*Rodgers, Meyer & Co		212 Battery.
*Roma, J. M	Residence	708 O'Farrell
*Rosenstock, S. W. & Co	Boots and Shoes	S. E. cor. Sansome & Bush.
*Rosseter & Smith	Leather and Shoe Findings	545 Market.
*Rule, F. K	Residence	702 McAllister.
*Russ House	S. H. Seymour & Co., Props.	Montgomery Street.
*Sabin, Jno. I	Supt. G. & S. Tel. Co.	1812 Pierce.
*Salfield, C. D	Physician	34 Kearny.
*Schweitzer, Sachs & Co	Importers	25 and 27 Battery.
*Simpson, Jas	Physician	234 Post.
*St. Lawrence Stables	Livery	212 Sutter.
*S. F. Chronicle	Chas. De Young & Co	506 Montg. and 423 Clay.
*S. F. Candle Co	Office	402 Front.
*S. F. Candle Co	Works	N. E. Cor. Alameda and Rhode Island.
*San Francisco Gas Light Co		Cor. First and Natoma.
*S. F. Law Library		27 & 28 Montgomery Block.
*S. F. News Letter	Publishers	609 Merchant.
*S. F. and North Pacific R. R. Co.	Peter Donahue, Pres.	426 Montgomery.
*S. F. & Pacific Glass Wk's.	C. Newman	King St.
*S. F. Steamboat & Transportation Co.	Miller & Eaton, Agts.	Jackson St Whf.
*S. F. Ten Cent Parcel Delivery		16 Post.
*Scannell, D	Chief Engineer Fire Dept	Old City Hall.
*Schlueter & Volberg	Carpets	709 Market.
Schmitt, Maurice	Residence	Sutter and Gough.
*Scott & McCord	Hay and Grain	Pier 21 Stuart.
*Scott, H. T	Residence	1822 Sacramento.
*Scott, Irving M	Residence	507 Harrison.
*Searby, Wm. M	Druggist	869 Market.
*Seattle Coal and Transportation Co		30 Market.
*Shattuck & Fletcher	Printing & Lithograph'g Inks	520 Com'l.
Shaw's Pharmacy	H. B. Shaw	Powell and Sutter.
*Sherman & Hyde	Music Store	Sutter and Kearny.
*Shorb, J. C	Physician	407 Post.
*Sims, Harry L	Physician	703 Market.
*Slaven, H. B	Druggist	Market and Powell.
*Slocum, Lot D	Excelsior Stables	921, 923, 925 Sutter.
*Sloss, Louis & Co	Hides, Wool and Furs.	310, 312 Sansome.
*Sloss, Louis & Co	Warehouse	Townsend and 3d.
*Smith, Francis & Co	Manufs. Sheet-Iron Pipe	130 Beale.
*South End Grain Wareh'se.	Jno. Jennings	Japan and Townsend.
*South Point Warehouse	T. G. Walkington	Berry, bet. 3rd and 4th.
*Spaulding, John & Co.	Pioneer Carpet Beat'g Mach.	353 Tehama.
*Sperry & Co	Commission Merchants	22 California.

*All names prefixed by star (*) are connected with the Central System.

NAME.	BUSINESS.	LOCATION.
*SPLIVALO, C. R.	Cal. Italian Paste Co.	704 Sansome.
*SPLIVALO, C. R.	Cal. Italian Paste Co.	6th and Berry.
*SPRING VAL. WATER WORKS.	General Office	516 California.
*SPRING VAL. WATER WORKS.	Yard	Bryant and Fourth.
*ST. GEORGE STABLES	A. B. BUTLER	Bush, above Kearny.
*STALLARD, J. H.	Physician	37 Post.
*STANDARD THEATRE	M. A. Kennedy	Bush St.
*STARR, WM. M.	Occidental Grain Warehouse	First & Townsend.
*STARR & CO.	Flour and Grain	16 California.
*STAUB, H.	Druggist	Sutter and Larkin.
*STEIGER & KERR	Occidental Foundry	137 First.
*STRAUSS, LEVI & CO.	Importers of Dry Goods, Clthng and Frnshng Goods.	14 and 16 Battery.
*STUART, WM.	Mining Secretary	12 Halleck Building.
*SURVEYOR-GENERAL'S OFFICE.	Theo. Wagner	610 Commercial.
*SWAIN, J. H.	Livery Stable	417 Folsom.
*SWAN, G. W. & CO.	Box Factory	114 Spear.
*SWAN, G. W. & CO.	Box Factory	416 Davis.
*SWAN THE PAINTER		727 Market.
*TABER, HARKER & CO.	Wholesale Grocers	108 and 110 California.
*TABER, I. W. & CO.	Photographic Art Gallery	8 Montgomery.
*TAY, GEO. H. & CO.	Stoves and Tinware	614 Battery.
*TAYLOR, F. B. & CO.	Imp'trs and Com'sion M'ch'ts	120 Front.
*TAYLOR, JOHN & CO.	Druggists' Glassware	512 Washington.
*TAYLOR, JNO. W.	Gutta Percha	501 Market.
*TAYLOR, F. B.	Residence	2422 Howard.
*TENNEY, RICHARD P.	Commission	Market & Davis.
*TERMINUS DRUG STORE	Abramson & Bacon	Sutter & Dupont Sts.
*TEVIS, LLOYD	Capitalist	Sansome and California.
*THAYER, B. B.	Chemist, Apothecaries Hall	Under Grand Hotel.
THAYER, B. B.	Residence	800 Ellis.
*THE COMMERCIAL AGENCY	Edwards, Pickens & Fulton	401 California.
*TILLMAN & BENDEL	Grocers	407 Clay.
*TOMKINSON, JAMES	Livery, Hack & Sale Stable	57, 59 & 61 Minna.
*TOWNSEND, W. S.	Palace Steam Candy Factory	627 Market.
*TOWNSEND, W. S.	Branch Palace Candy Factory	203 Kearny.
TRAYLOR, W. W.	Residence	Broadway and Webster.
*TRUMAN, I. J.	Residence	812 Twentieth.
*TRUMPOUR & CHRISTENSON	Dentists	2021 Mission.
*TRUMPOUR, J. P.	Dentist	401½ Hayes.
*TUBBS & CO.	S. F. Cordage Factory	613 Front.
*UNDERWRITERS' FIRE PATROL		Ecker and Stevenson.
*UNION BOX FACTORY	G. W. Swan & Co.	114 Spear.
*UNION CLUB		California and Montgomery.
*UNITED CARRIAGE CO.	Hacks and Coupés	Palace Hotel.
*UNITED CARRIAGE CO.	Hacks and Coupés	Baldwin Hotel.
*UNITED CARRIAGE CO.	Hacks and Coupés	Sutter and Leavenworth.
UNITED WORKINGMEN	Boot and Shoe Co.	416 Market.
UNITED WORKINGMEN	Boot and Shoe Co.	25th and Bartlett.
*UNION IRON WORKS	Business office, and connecting with the several dep'ts.	First and Mission.

* All names prefixed by star (*) are connected with the Central System.

NAME.	BUSINESS.	LOCATION.
*U. S. BRANCH MINT		Fifth & Mission.
*VAN WINKLE, I. S. & CO.	Iron, Steel & C'mberl'd Coal	413 and 415 Market.
*VERDENAL, D. F.	Mining Secretary	327 Pine.
*VERMEIL & WELLINGTON	Hay and Grain	608 Fourth.
*VERMEIL & WELLINGTON	Hay and Grain	Berry, bet. 5th and 6th.
*VERMEIL, J. L.	Residence	24th & Harrison.
*WAGNER, THEO.	Surveyor-General	610 Commercial.
*WAGNER, THEO.	Residence	2101 Hyde.
*WAKELEE, H. P. & CO.	Druggist	Montgomery and Bush.
*WALKINGTON, T. G.	South Point Warehouse	Berry, bet. 3rd and 4th.
*WALDSTEIN, A.	Lithographer	Sacramento and Sansome
*WALDSTEIN, A.	Cigar Box Factory	Berry near Sixth.
*WANGENHEIM, SOL. & CO.	Packing and Canning	120 Davis.
*WATERMAN, M. & CO.	Produce & Com'sn Merch'ts.	111 Clay.
*WATERS, ARTHUR	Occident Stable	Geary and Polk.
*WATERS, CHAS.	Plumber	30 O'Farrell.
*WEEMS, J. P. & CO.	Coal Dealers	234 Fifth.
*WEISS & FELDMANN	Opera Saloon	327 Bush.
*WELLMAN, PECK & CO.	Grocers	416 Front.
*WELLS, FARGO & CO'S EXPRESS.	J. J. Valentine, Gen. Supt.	Sansome and Halleck.
*WELLS, FARGO & CO'S BANK	Lloyd Tevis, Pres.	Sansome and California.
*WELLS, GEO. R.	Residence	1004 Geary.
*WEST COAST FURNITURE CO.	Salesroom	Second and Market.
*WEST COAST FURNITURE CO.	Factory	Fourth and Bryant.
*WESTERN UNION TEL. CO.		Pine and Montgomery.
*WESTERN ELECTRIC LIGHT CO.		412 Market.
*WETHERBEE, CHAS. L.	Manager	Occidental Hotel.
*WHARTENBY, JAMES	Residence	408 Ellis.
*WHITE, CAPT. RUSSELL	Fire Patrol	Stevenson.
WHITE, CAPT. RUSSELL	Residence	174 Jessie.
*WHITELAW, THOS. P. H.	Ship Chandler	Foot of Second.
*WHITELAW, THOS. P. H.	Residence	401 Bryant.
*WHITNEY & CO'S EXPRESS.	Oakland, Alameda, Brookl'n Berkeley, Temescal,	3 and 5 Commercial.
*WHITNEY & WEBSTER	Wool Warehouse.	King St.
*WHITNEY, J. P.	Physician	204 Sutter.
*WHITNEY, J. P.	Physician	1007 Sutter.
*WHITNEY, J. D.	Physician	204 Sutter.
*WHITNEY, J. D.	Physician	Lick House.
*WIENER, E. O.	S. F. Steamboat and Transportation Co	Jackson St. Wharf.
*WILLIAMS, BLANCHARD & CO.	Agents P. M. S. S. Co.	218 California.
*WILLIAMS, BLANCHARD & CO.	Dock	First and Brannan.
*WILSON & WILSON	Attorneys	420 California.
*WILSON, J. Y. & CO.	Provision Packers	508 Market,
*WILSON, J. Y. & CO.	Provision Packers	Buchanan and Bay.
*WILSON, JNO. SCOTT	Residence	2416 Washington.
*WILSON & HUTCHINSON	Stock Brokers	322 Pine.
WINDELL, H.	Residence	310 Stockton.
*WINDSOR HOUSE	Warschauer Bros.	905 Market.
*WORTH, SIDNEY	Physician	426 Sutter.
*WOOD, F.	Residence	2923 Sacramento.
*YATES & CO.	Paints and Oils	113 Front.
*YATES, R. R.	Sell. Agt. Cal. Silk M'f'g Co.	585 Market.
*YATES & CO.	Oil Warehouse	223 Main.
ZELNER, WM.	Druggist	5th and Mission.

* All names prefixed by star (*) are connected with the Central System.

MEDICAL DIRECTORY.

Physicians and Surgeons,

CONNECTED WITH THE CENTRAL SYSTEM.

NAME.	OFFICE.	RESIDENCE.
AYER, WASHINGTON	410 Kearny	*1622 Clay.
Office Hours, 8 to 9 a. m., 2 to 4 p. m.		
BAZAN, F	*850 Market	*1633 Mission.
Office Hours at Residence, 11 a. m. to 1 p. m. and 4 to 6 p. m.		
BENNETT, THOS	620 Market	*716 Pine.
Office Hours, 2 to 4 p. m.		
BOYSON, THOMAS	*112 Kearny	*112 Kearny
Office Hours, 11 a. m. to 1 p. m., 6 to 8 p. m. Generally at Home between 11 p. m. and 8 a. m.		
CHISMORE, GEO	*920 Market	*920 Market.
Office Hours, 1 to 3 and 7 to 8 p. m.		
COLE, R. BEVERLY	*518 Sutter	*518 Sutter.
Office Hours, 12 to 3 p. m.		
DEANE, C. T	*321 Ellis	*321 Ellis.
Office Hours, 12 to 3:30 and 6 to 7:30 p. m.		
DORR, L. L. (Coronor)	*118 Dupont	2320 Mission.
Office Hours, from 10 a. m. to 12 m., 3 to 5 p. m. At Home, 5:30 p. m. to 9 a. m.		
DOUGLASS, WM. A	*126 O'Farrell	*126 O'Farrell.
Office Hours, 1 to 3 and 7 to 8 p. m.		
ECKEL, J. N	*324 Geary	*324 Geary.
Office Hours, 12 a. m. to 1 p. m., 6 to 7 p. m.		
FRASER, E. J	*221 Powell	*221 Powell.
Office Hours, 8 to 9 a. m. and 1 to 3 and 6 to 8 p. m.		
HALE, WM. F	*520 Kearny	*516 Taylor.
Office Hours, 2 to 5 p. m.		
HIRSCHFELDER, JOS. O	126 Kearny	*1326 Geary.
Office Hours, 1 to 3 p. m. Sundays, 10 to 11 a. m.		
HUBBARD, H. H	*22 Geary	*22 Geary.
Office Hours, 12 to 3 p. m.		
INGERSON, H. H	*323 Geary	*323 Geary.
Office Hours, 9 to 10 a. m., 4 to 6 and 7 to 8 p. m.		

*A star indicates the location of Telephone, whether at Residence, Office, or both.

NAME.	OFFICE.	RESIDENCE.
LANE, L. C	*652 Mission	*Clay and Buchanan.
Office Hours, 1:30 to 4 p. m. At Home. 7 to 8 p. m.		
LEWITT, WM	*16 Turk	*16 Turk.
Office Hours, 1 to 3 p. m., and in the Evening.		
MARSHALL, BENJAMIN		*S. W. cor. Valencia and 21st.
Office Hours, 10 a. m. and 8 p. m.		
MAXWELL, R. T	*135 Kearny	*135 Kearny.
Office Hours, 2 to 5 p. m., and in the evening.		
McNULTY, J. M	*118 Dupont	*Palace Hotel.
Office Hours, 9 to 10 a. m. 1 to 3 p. m. At Hotel after 5 p. m.		
McNUTT, W. F	121 Montgomery	*808 Bush.
Office Hours, 12 to 3 and 7 to 8 p. m.		
MEDICAL COLLEGE		*Cor. Stockon & Francisco.
MOORE, C. W	*652 Market	*652 Market.
Office Hours, 8 to 10 a. m. 12 to 4 and 8 to 10 p. m.		
MURPHY, JAMES	*659 Clay	*1613 Van Ness.
Office Hours, 8 to 9 a. m., 1 to 3 and 7 to 9 p. m.		
PALMER, GEO. H	*424 Post	*424 Post.
Office Hours, 8 to 10 a. m. 3 to 4 and 7 to 8 p. m.		
PEASE, G. M	*125 Turk	*125 Turk.
Office Hours, 1 to 4 p. m.		
PROSEK, J	*O'Farrell and Dupont	*418 Van Ness.
Office Hours, 12 to 2 and 7 to 8 p. m. Sundays, 11 to 12.		
RICHTER C. MAX	*126 Kearny (Thurlow Block)	*914 Post.
Office Hours, 12 to 2 and 7 to 8 p. m.		
SHORB, J. C	*407 Post	*407 Post.
Office Hours, 8 to 9 a. m., 3 to 5 and 7 to 8 p. m.		
SIMPSON, JAS	*234 Post	814 Sutter.
Office Hours, 9 a. m., 1 to 3 and 7 to 8 p. m.		
SIMS, HARRY L	*703 Market	*703 Market
Office Hours, 1:30 to 4 p. m.		
STALLARD, J. H	*37 Post	*37 Post.
Office Hours, 12 to 3 and 7 to 8 p. m.		
WHITNEY, J. P	*204 Sutter	*1007 Sutter.
Office Hours, 3 to 5 p. m.		
WHITNEY, J. D	*204 Sutter	*Lick House.
Office Hours, 9 to 10 a. m. 12 to 2 and 7 to 8 p. m.		
WORTH, SIDNEY	*426 Sutter	*426 Sutter.
Office Hours, 8 to 9 a. m. 2 to 4 and 6 to 7½ p. m.		

*A star indicates the location of Telephone, whether at Residence, Office, or both.

Druggists.

ABRAMS & CARROLL........3 and 5 Front.
ABRAMSON & BACON........Sutter and Dupont.
ABRAMSON & BACON........717 Clay.
BAYLY, CHAS. A........Sixth and Howard.
BERGER, C. F........Eddy and Steiner.
BRYAN, W. J........Apothecaries Hall, under Grand Hotel.
BURNETT, G. G........327 Montgomery.
BURT & Co........California and Fillmore.
COFFIN & MAYHEW........Mission and 20th.
CRANE & BRIGHAM........520 Market.
EVANS, A........Hayes and Laguna.
KEARNEY, PETER A........First and Folsom.
KEIL, F. C........Market and 4th.
LANGLEY, CHAS. & CO........Pine and Front.
LEIPNITZ & CO........236 Sutter.
MEYERS, R. C........Powell and Union.
McDONNELL, J. J........Market and 6th.
PAINTER, EMLEN........Clay and Kearny.
PAINTER, EMLEN........Misson and 11th.
REDINGTON & CO........529 Market.
SEARBY, WM. M........869 Market.
STAUB, H........Sutter and Larkin.
SHAW'S PHARMACY........Sutter and Powell.
SLAVEN, H. B........Market and Powell.
TAYLOR, JNO. & CO., Druggists' Glassware........512 Washington.
WAKELEE, H. P. & CO........Montgomery and Bush.
ZELNER, WM........Mission and 5th.

ATTORNEYS-AT-LAW.

BARNES, W. H. L........426 California.
FLOOD, NOAH F........1904 Laguna.
GALLAGHER, THOS. J........602 Commercial.
GREATHOUSE & BLANDING........324 Pine.
HAGGIN, J. B........51 Nevada Block.
KNOX, GEO. T........Notary Public........444 California.
LAKE & McKOON........310 Pine.
LLOYD & NEWLANDS........13 Nevada Block.
MASTICK, BELCHER & MASTICK........520 Montgomery.
McALLISTER & BERGIN........38 Nevada Block.
NAPHTALY, FREIDENRICH & ACKERMAN........426 California.
ROCHE & DESBECK........30 Montgomery Block.
WILSON & WILSON........420 California.

American District Telegraph.

NIGHT-WATCHMAN SIGNALS.

Attention is called to our WATCH SERVICE Department, which consists in placing a number of District Boxes throughout your establishment, so located that, to reach them, your watchman must travel over every portion of the premises.

Signals are given from each instrument, at proper intervals, and automatically recorded in one of our offices (a copy of which is sent you daily). No two instruments can give the same signal, and upon the failure, FROM ANY CAUSE, of the *correct* signal to record itself in our office, a police officer will immediately visit the premises to ascertain the cause of neglect or trouble; and in case any suspicious circumstances are noticed, remain on duty at the place and notify you by telegraph of the facts. In this respect it is far superior to any watch-clock, for the reason that any irregularities are attended to before it is too late to prevent serious consequences.

LIST OF SUBSCRIBERS TO NIGHT WATCH SERVICE.

ANGLO-CALIFORNIAN BANK........California and Leidesdorff
BANK OF CALIFORNIA........California and Sansome.
BANK OF BRITISH COLUMBIA........California and Sansome.
BAKER & HAMILTON........13 Front.
BOREL, A........Montgomery and Clay.
BRADBURY, W. B........556 Brannan.
CROCKER, CHAS........California and Taylor.
CHICAGO BREWERY........1420 Pine.
CALIFORNIA FUSE WORKS........Mission Creek
CUTTING PACKING CO........17 Main.
DINKELSPIEL, S. B........313 Bush.
DONOHOE, KELLY & CO........Montgomery and Sacramento.
FRENCH SAVINGS AND LOAN SOCIETY........411 Bush
GERMAN SAVINGS AND LOAN SOCIETY........526 California.
GREENWICH DOCKS........Foot Battery Street.
HIBERNIA BANK........Montgomery and Market.
HOLLAND & RAPPEL........Beale and Mission.
HOWES, E. K. & CO........Main and Mission.
HOBBS, POMEROY & CO........11 Beale
LAZARD FRERES........205 Sansome.
LEVI STRAUSS & CO........14 Battery.
LONDON & S. F. BANK........California and Leidesdorff.
MURPHY, GRANT & CO........Sansome and Bush.
NEVADA BANK........Montgomery and Pine.
ODD FELLOWS' HALL........Montgomery Street.
PACIFIC POWER CO........Jessie and Ecker.
REESE LLEWELLYN........133 Beale.
S. F. SAVINGS UNION........California and Webb.
U. S. SUB-TREASURY........Commercial Street.
WELLS, FARGO'S BANK........California and Sansome.
WHITTIER, FULLER & CO........Pine and Front.

NOTICE.

All persons are warned against using the so called "Bell Telephone," or any other Telephone not procured from this Company, as recent patents and re-issues of patents have established the rights of our principals. Suits have already been brought against a number of individual infringers on this coast, and all infringers will be sued as rapidly as discovered.

GOLD AND STOCK TELEGRAPH CO.
OF CALIFORNIA,
AGENTS.

1879-10-15

GEO. S. LADD, *President.*
JNO. I. SABIN, *Sup't.*

JAS. GAMBLE, *Vice Pres't.*
M. GREENWOOD, *Treas.*

EDISON'S SPEAKING CARBON TELEPHONE.

LIST OF SUBSCRIBERS

CONNECTED WITH THE

Central Office System.

San Francisco, October 15, 1879.

NOTICE.

Any subscriber can be switched into direct and perfectly private speaking communication with any other subscriber, at a moment's notice, day or night.

Telephones connected with the Central System have been placed at the

DISTRICT TELEGRAPH OFFICES:

222 SANSOME STREET,
961 MISSION STREET,
POWELL and UNION,
HAYES and LAGUNA,
S. W. Cor. KEARNY and SUTTER,
TWENTIETH and MISSION,
833 SUTTER STREET,
BUTCHERTOWN,
CALIFORNIA and FILLMORE.

For the accommodation of the public. Any person applying at one of these offices can converse, by Telephone, with any of our subscribers in the City, at the expense of 25 cts. for five minutes conversation.

GOLD AND STOCK TELEGRAPH CO.
OF CALIFORNIA.

Crocker & Co., Printers, 401 and 403 Sansome St., S. F.

NOTICE!

To facilitate rapid switching, each subscriber's wire will be designated by a number, placed opposite his name on the left hand margin of these pages. Some subscribers have two or more telephone stations on the same wire, and their stations are designated by a small figure placed at the right hand of the numbers described above.

Call the Central Office, and give the number of the wire instead of the name of the person you wish to converse with. If it happens that the person has two or more stations on his wire, give his station number also.

EXAMPLE.—If Mr. Badlam's office is wanted, say "170, Station 3;" but if Mr. Badlam's residence is wanted, say "170, Station 2," &c.

TELEPHONES RENTED AND LINES CONSTRUCTED.

LIST OF SUBSCRIBERS.

NO.	NAME.	BUSINESS.	LOCATION.
34	ABRAMS & CARROLL	Druggists	3 and 5 Front.
139	ABRAMSON & BACON	Druggists	Dupont and Sutter.
139^{2}	ABRAMSON & BACON	Druggists	717 Clay.
135^{3}	ACKERMAN BROS.	Fancy Goods	123 Kearny.
226	ÆTNA IRON WORKS	Pendergast & Smith	217 to 221 Fremont.
2012	AHRENS & CO	Chicago Brewery	1420 Pine.
145^{3}	ALAMEDA B. & L. ASS'N.	Ch. C. Volberg, Pres't	709 Market.
144	ALAMEDA B. & L. ASS'N.	Moritz Friedrich, Sec'ry	309 California.
172m	ALASKA COMMERCIAL CO	Louis Sloss & Co	310, 312 Sansome.
172^{2}	ALASKA COMMERCIAL CO	Warehouse	Third and Townsend.
173^{3}	ALASKA COMMERCIAL CO	Tannery	Ninth near Brannan.
160^{2}	ALMS HOUSE		Mission Ocean Road
281	ALTA CALIFORNIA	Daily Newspaper	529 California.
229	ALLEN, C. R.	Coal	120 Beale.
253^{2}	ALLEN & LEWIS	Commission Merchants	202 California.
5023m	ANDERSON, GEO. L.	A. A. Q. M. & A. C. S.	Presidio.
339	ARGONAUT, THE.		522 California.
240^{3}	ARMSTRONG & WRIGHT	M'f'rs of Boots and Shoes	67 and 69 Stevenson.
5023	ARMY HEADQUARTERS		105 Stockton.
	ASHBURNER, WM	Residence	1014 Pine.
5020	ASHTON, CHAS.	Room 80	120 Sutter.
170^{3}	ASSESSOR'S OFFICE	City and County	New City Hall.
2041	AYER, WASHINGTON	Physician	1622 Clay.

NO.	NAME.	BUSINESS.	LOCATION.
313	Bachman Bros	Importers Dry Goods	10 and 12 Battery.
170^{3}	Badlam, A.	Assessor's Office	New City Hall.
170^{2}	Badlam, A.	Residence	708 California.
32^{2}	Baker & Hamilton	Hardware	7-19 Front
32^{3}	Baker & Hamilton	Hardware	2nd and Townsend.
3036	Baldwin Hotel	Alex. MacAbee, Bus. Man'r.	Market and Powell.
3004	Baldwin Pharmacy	H. B. Slaven	Market and Powell.
334	Balfour, Guthrie & Co.	Grain, Shipping, Com. Mers.	316 California.
82	Bancroft, A. L. & Co.	Printing Department	721 Market.
333^{2}	Bancroft, A. L. & Co.	General Business	721 Market.
108	Bangs, Edward	Grain	Mission Bay Wareh'e.
344 — ~~[illegible]~~	Barker & Snow	Plumbers' Supplies	408 Market.
273	Barnard, Frank & Co.	Coal Dealers	East and Jackson.
273^{2}	Barnard, Frank & Co.	Coal Dealers	213 Jackson.
252	Barnes, Col. W. H. L.	Attorney at Law	426 California.
2036	Barron, Edward	Residence	413 Hyde.
2052	Barney, Gen'l B. G.	Residence	2209 Jackson.
2015	Bastheim, J.	Residence	1509 Gough.
5023	Batchelder, R. N.	Depot Quartermaster	Stockton & O'Farrell.
127	Battery St. Bon'd Wareh'e.	Geo. C. Bode & E. Danforth	Battery and Filbert.
3013	Bay City Market	M. Gradwohl & Co.	1146 Market.
7012	Bay Soap & Candle Works	Lavenson & Winter	South San Francisco.
116	Bay Sugar Refinery	Herman Meese, President	Battery and Union.
3045	Bayly, Chas. A.	Druggist	Sixth and Howard.
3032	Bazan, F.	Physician	850 Market.
3033	Bazan, F.	Residence	1633 Mission.
156	Benson, John A.	Surveyor & Engineer	507 Montgomery.
109	Bent, E. F. & Co.	Grain	18 California.
5018	Bennett, Thos.	Physician	716 Pine.
155	Bernard, Chas.	Coffee and Spice	707 Sansome
4004	Berger, C. G.	Druggist	Cor. Eddy & Steiner.
	Berry, Gid. M.	Residence	1728 Tyler.
201	Biggs, A. R.	Saloon	Pine and Sansome.
3015	Black, Henry M.	Carriage Maker	851 Market.
5023m	Black Point	Military Station.	
2005	Blake, Geo. M.	Residence	1601 Van Ness.
199	Blake, Robbins & Co.	Paper Warehouse	516 Sacramento.
78	Board of Education	General Office	New City Hall.
76^{2}	Board of Education	Col. J. A. Laven	30 Sacramento.
78^{3}	Board of Education	J. W. Taylor	501 Market.
78^{4}	Board of Education	A. C. Hiester, President	S. F. Stock Ex. B'g.
77	Board of Education	Capt. Wm. A. Phillips	Folsom St. Wharf.
2013	Board of Education	Carpenter Shop	Pine and Larkin.
3019	Board of Supervisors	Clerk's Office	New City Hall.
119	Board of Trade		123 California.
128^{2}	Bode, Geo. C.	Warehouse	1201 Battery.
128	Bode, Geo. C.	Office	30 Market.
133	Boothe, W. H.	Capitalist	320 California.
132	Boothe, W. H.	Residence	Cor. Fillmore & McAllister.
340	Bowley Bros	Carriage Repository	435 California.
340^{2}	Bowley Bros	Repository and Sale Stables.	N. Montg. & Mission.

NO.	NAME.	BUSINESS.	LOCATION.
5012	Boyson, Thomas	Physician	112 Kearny.
54	Bradbury, W. B.	Centennial Planing Mills	556, 572 Brannan.
111^{4}	Bray Bros	Commission Merchants	226 Clay.
127	Broadway Bon'd Wareh'se.	E. Danforth	Broadway & Battery.
5059^{2}	Brunswick House	D. Stern	Sixth and Howard.
5017	Bryan, W. J.	Druggist, Apothecaries Hall.	Grand Hotel.
2051	Bryant, Hon. A. J.	Residence	822 Sutter.
67^{2}	Buckingham & Hecht	Boots and Shoes	528 Market.
67	Buckingham & Hecht	Boots and Shoes	Haight and Gough.
	Bullion Mining Co.	Jos. Gruss, Sec'y.	418 California.
244	Burnett, G. G.	Apothecary	327 Montgomery.
4000	Burt & Co.	Druggists	California & Fillmore.
158	Cabrera, Roma & Co.	Commission	123 California.
3043	Cal. Carpet Beating Machine	P. Merrill	453 Stevenson.
10^{5}	California Cracker Co.	Bakers	206 and 208 Sac.
10^{2}	California Cracker Co.	Bakers	Battery & Broadway.
7011	Cal. Dry Dock Co.	Dry Dock	Hunters Point.
117	Cal. Dry Dock Co.	Office	318 California.
117^{3}	Cal. Dry Dock Co.	Floating Docks	Spear and Bryant.
29	California Electrical Works		134 Sutter.
20^{2}	Cal. Furniture Co.	Furniture	222 Bush.
20	Cal. Furniture Co.	Furniture	649 Market.
63^{2}	California Paint Co.	Paints	329 Market.
63	California Paint Co.	Paints	27 Stevenson.
7006	Cal. Silk Man'f'g Co.	Robt. Morrison	Cor. P. & 11th Av., South S. F.
306	Cal. Steam Navigation Co.	Office	Washington St. Whf.
87^{3}	California St. R. R. Co.		Cal. and Cemetery Ave.
87^{4}	California St. R. R. Co.		California and Larkin.
87^{5}	California St. R. R. Co.		California and Kearny.
255^{5}	Cal. Wire Works Co.	Wire	6 California.
5023	Campbell, J. B.	Post Commander	Black Point.
182	Campi's Restaurant	N. Giamboni & Co.	533 Clay.
271	Carlisle, A. & Co.	Commercial Stationers	110 Leidesdorff.
3056	Carvill Manufacturing Co.	Carriage Builders	1 and 9 Powell.
293	Castle Bros	Merchants	213 Front.
183^{2}m	Catania, J.	Fish Market	502 Merchant.
54	Centennial Planing Mills	W. B. Bradbury	556, 572 Brannan.
213	Central Pacific R. R. Co.	General Offices	Fourth & Townsend.
139	Central Drug Store	Abramson & Bacon	Sutter & Dupont
185	Chadbourne & Co.	Furniture Dealers	735 Market.
2012	Chicago Brewery	H. H. Ahrens	1420 Pine.
79	Chief of Police	Old City Hall	Kearny Street
3047	Chismore, Geo.	Physician	920 Market.
31	Christy & Wise	Wool	607 Front.
	Chy Lung & Co.	Chinese Merchants	521 Kearny.
	Chy Lung & Co.	Chinese Merchants	640 Sacramento.
319 — ~~[illegible]~~	City Iron Works	Low & Chartrey	26 and 28 Fremont.
5065	Clark, Geo. W.	Paper Hangers, Window Shades	645 Market.
5063	Clarke, J. J.	Physician	106 Stockton.
97	Clayton, Chas.	Grain Dealer	400 Front.
68^{2}	Club Stables	C. S. Crittenden	Taylor Street.

NO.	NAME.	BUSINESS.	LOCATION.
52	Code, Elfelt & Co	Packing and Canning	125 Main.
51^2	Code, Elfelt & Co.	Packing and Canning	314 Washington.
8^3	Coey, Gen. James	Postmaster	30 Twelfth.
337	Coffin & Hendry	Ship Chandlery	2 to 8 Market.
6000	Coffin & Mayhew	Druggists	Mission and 20th.
5022	Cole, R. Beverly	Physician	518 Sutter.
112	Coleman, Wm. T. & Co.	Shipping and Commission	California and Front.
157	Coleman, Evan J.	Prest. Pac. Transfer Co.,	618 Harrison.
5070	Collie & Jones	Florists	18 Post.
234	Collins, S. P. & Co	Saloon	329 Montgomery.
5056	Concordia Club		102 O'Farrell.
203	Conro, F. D. & Son	Golden Age Flouring Mills	717 to 721 Battery.
165^2	Continental Oil and Transportation Co. of Cal.		120 Front.
165	Continental Oil and Transportation Co. of Cal.		Wareh'se, Berry & 5th.
263	Cook, H. N	Manf'r Leath'r Belt'g & Hose	415 Market.
264	Cook & Ellis	Manf's Leath'r Belt'g & Hose	37 Fremont.
228	Cosmopolitan Hotel		Bush and Sansome.
121^2	County Clerks Office		Old City Hall.
110	County Clerks Office		New City Hall.
210^{2}m	County Hospital		Potrero Ave. bet. 22d & 23d.
104	Corporation Yard	Fire Department	50 Sacramento.
113	Cox, J. W. & Co	Cunningham's Warehouse	Green and Front.
113^2	Cox, J. W. & Co	North P. D. F. Warehouse	Foot of Sansome.
114^2	Cox, J. W. & Co	Humboldt Whf. Warehouse	Spear, bet. Fol. & Harrison.
26	Crane & Brigham	Druggists	520 Market.
68^2	Crittenden, C. S	Club Stables	Taylor Street.
68	Crittenden, C. S	Office	311 Bush.
27	Crocker, H. S. & Co	Stationers and Printers	Sansome and Sac'to.
5004	Crosett & Co	Employment Agency	230 Sutter.
320	Cunningham, Curtis & Welch	Stationers and Printers	327 to 331 Sansome.
13	Cunningham's Warehouse	J. W. Cox & Co	Green and Front.
41	Cutting & Co	Packing and Canning	17 Main.
78^4	Daily Stock Report	Publishers	S. F. Stock Exchange B'ldg.
335	Daneri, F. & Co	Grocers	504 Front.
127	Danforth, E	Broadway Bon'd Warehouse	Broadway & Battery.
2011	Danforth, E.	Residence	1200 Mason St.
5011	Davis Bros	Golden Rule Bazaar	419 Kearny.
5010	Davis Bros	Golden Rule Bazaar	718 Market.
5051	Day, Thos	Gasfitter	122 Sutter.
2046	Deane, C. T	Physician	321 Ellis Street.
275	Degen, L. P	Manuf. Leather Belting	10 Fremont.
2032	Degener, E	Residence	Eddy and Laguna.
322	Degener & Co	Merchants	308 California.
5047	Devine, James	Druggist	214 Kearny.
50	Deming, Palmer & Co	Flour Mills	202 Davis.
75^2	Dewey & Co	Publishers	202 Sansome.
75	Dewey & Co	Publishers	414 Clay.
5052^2	DeYoung, Chas. & M. H	Residence	317 Eddy.
168	Dodge, W. W. & Co	Grocers	401 Front.
125^2	Dodge, Sweeney & Co	Wholesale Provisions	406 Front.
301	Dohrmann & Co	Washington Mills	N.W. cor. Wash'n & Drumm.

NO.	NAME.	BUSINESS.	LOCATION.
5030	Dolliver & Bro	Imp. Leather & Shoe Find'gs	107 Post.
245	Donahue, Peter	Capitalist	426 Montgomery.
5066	Dorr L. L	Physician, 118 Dupont	Res. Mission & 20th.
5046	Douglass, Wm. A	Physician	126 O'Farrell.
223	Dunham, Carrigan & Co	Hardware, Iron, Steel, etc.	107 Front.
69	Dunphy & Hildreth	Butchers	533 Kearny.
7007	Dunphy & Hildreth	Butchers	Butchertown.
2028	Dunphy, Wm	Residence	111 Mason.
9	Durkee, J. L	Fire Marshal	Old City Hall.
233	Dutard, H	Commission Merchant	217 and 219 Clay.
321	Dutton & Withington	Stationers and Printers	306 California.
	Earle, H. H	Residence	2222 Jackson.
276	Ebbets, A. M	Imp. & Dealers in Coal	109 to 115 Sacram'nto
5068	Eckel, J. N	Physician	324 Geary.
206	Edwards, Pickens & Fulton	The Commercial Agency	401 Cal.
5023	Egan, John	Commanding Post	Fort Point.
2029	Ehrman, M	Residence	519 Van Ness Ave.
323	Ehrman, M. & Co	Wholesale Grocers	104, 106, 108, 110 Front.
6^2	Einstein Bros & Co	Boots & Shoes	26 & 31 Battery St.
6	Einstein Bros. & Co	Boots & Shoes	115 & 117 Hayes St.
2015	Einstein, Z	Residence	1509 Gough.
117	Eldridge, Oliver	Pres't Cal. Dry Dock Co.	318 California.
209	Elfelt, A. B. & Co	Importers Clothing and Gents Furnishing G'ds.	108 & 110 Sansome.
	Elliott, Mrs	Residence	1817 Eddy.
5054	Eureka Nursery	E. Meyer	Foot of Stanyan.
39^2	Eureka Warehouse	A. J. Gove	Mont. and Chestnut.
259	Evening Post	Publishers	502 Montgomery.
188	Evers, Henry	Noltings Billiard Saloon	801 Kearny.
2019	Evans, A	Druggist	Hayes and Laguna.
131	"Examiner"	Daily Paper	533 Washington.
2025	Excelsior Stables	Lot. D. Slocum	921, 923, 925 Sutter.
	Falkner, Bell & Co		430 California.
18	Fashion Stables	McCord, Bridge & Co	Ellis near Mason.
310	Fechheimer, Goodkind & Co.	Cloth'g & Furish'ng Goods.	16 and 18 Sansome.
135^2	Feigenbaum & Co	Fancy Goods	120 Sansome.
178	Felton, C. N	Capitalist	402 Montgomery.
268	Ferguson John	Saloon	304 California.
4002	Field, Stephen D	Electrician	2321 California.
107	Fire Department	Chief Engineer's Office	Old City Hall.
104	Fire Department		Corporation Yard.
141	Fire Department	Engine No. 2	Bush, near Kearny.
2040	Fire Department	Engine No. 3	Cal. nr. Leavenworth.
3031	Fire Department	Engine No. 7	Valencia & Guerrero.
4003	Fire Department	Hose No. 2	Post and Fillmore.
197^2	Fire Patrol	Station 1	Stevenson and Ecker.
	Fire Patrol	Station 2	Grove and Larkin.
175	Flavin, M. J	Great I.X.L. Auc. House	612 to 620 Kearny.
175	Flavin, M. J	Residence	632 Geary.
269^2	Flint, Peabody & Co	Office	402 California.
2027	Flood, Noah F	Attorney, Residence	1904 Laguna.

NO.	NAME.	BUSINESS.	LOCATION.
115^{3}	FLOYD, T. W. & Co.	Overland Warehouse	Townsend b. 2d & 3d.
151	FLOYD, CAPT. RICHARD S.	Capitalist	415 First.
5023	FORT POINT	Military Station.	
	FOSTER, A. W	Residence	1213 Jones.
5019	FOUNTAIN SALOON	Wm. Hesse, Jr.	Sutter and Kearny.
5053	FRANK, A. L	Residence	612 Van Ness Ave.
5015	FRASER, E. J	Physician	221 Powell.
47	FRENCH MUTUAL BENEVOLENT SOCIETY		510 Jackson.
48	FRENCH HOSPITAL		Bryant and Sixth.
144	FRIEDRICH, MORITZ	Commission Merchant	309 California.
225	FULTON IRON WORKS	Hinckley, Spiers & Hayes.	207-213 Fremont.
172^{2}m	FUNCKE & Co	Tanners	9th St. near Brannan.
30	GAMBLE, JAMES	Genl. Supt. W. U. T. Co.	302 Montgomery.
198	GAMBS, FER'D	Liquor Dealer	305 California.
312	GARRATT, W. T	Brass Foundry	138 Fremont.
5058^{2}	GERMAN BENEVOLENT SOCIETY	Office	114 Dupont.
5058	GERMAN HOSPITAL		Noe and 14th.
267	GETLESON & LANDIS	Leather and Findings	543 Market.
286	GETZ BROS. & Co	Prov. and Com. Merchant	301 and 303 Front.
49	GHIRADELLI & DANZEL	Coffee and Spice	415 Jackson.
182	GIAMBONI, N. & Co.	Campi's Restaurant	533 Clay.
238	GIBBS, GEO. W. & Co	Iron, Steel & Blacksm's Tools.	33-39 Fremont.
117	GIBBS, W. C	Sec'y Cal. Dry Dock Co.	318 California.
53	GILBERT & MOORE	Furniture	219 Bush.
54	GILBERT & MOORE	Furniture	556 Brannan.
15	GLADDING, McBEAN & Co	Drain and Sewer Pipe	213 Market.
16	GLADDING, McBEAN & Co	Drain and Sewer Pipe	1312 Market.
195	GLOVER & WILLCOMB	Curled Hair Manufacturers and Bedding Supplies.	65 & 67 New Montgom'y.
191	GOODYEAR RUBBER CO.		577 and 579 Market.
138 m	GOODALL, PERKINS & Co.	Steamship Agents	10 Market.
203	GOLDEN AGE FLOURING MILLS.	F. D. Conro & Son	717 to 721 Battery.
5010	GOLDEN RULE BAZAAR	Davis Bros.	718 Market.
5011	GOLDEN RULE BAZAAR		419 Kearny.
39^{8}	GOVE, A. J.	Eureka Warehouse.	Chestnut and Montgomery.
288	GOWER & GILMAN	Storage	N.E.cor. Broadway and Battery.
3013	GRADWOHL, M. & Co.	Butchers	1146 Market.
25	GRANGERS' BUSINESS ASS'N		106 Davis.
2058	GRANT, T. C	Residence	1024 Bush.
279	GRAVE, B. & Co	Carriage & Wagon Makers.	421 and 423 Pacific.
43	GRAY, N. & Co	Undertakers	641 Sacramento.
167	GREATHOUSE & BLANDING	Attorneys	324 Pine.
313	GREENEBAUM & Co	Auctioneers & Com. Mchts.	115 Bush.
5043	GREENEBAUM, SACHS & FREEMAN.	Men's Fur'shing Goods.	524 Market.
2056	GREENEWALD, S	Residence	1717 Van Ness Ave.
	GREENWOOD, M	Treasurer G. & S. Tel. Co.	713 Hayes.
237	GREGORY, H. P. & Co.	Pac. Machinery Depot	2 and 4 California.
3035	GRISAR, E	Wool Warehouse	Fifth and Townsend.
30^{2}	GRUEN & VOGELSANG	Saloon	215 Third
30	GRUEN & VOGELSANG	Saloon	142 Fourth.
157	GWIN, HON. WM. M	Residence	618 Harrison.

NO.	NAME.	BUSINESS.	LOCATION.
274	HAAS BROS	Importers and Wholesale Grocers.	100-102 California.
5065	HAAS, GEO. & Co	Candy Manufactory.	20 Kearny.
186	HAGGIN, J. B	Attorney	51 Nevada Block.
2043	HAGGIN, J. B	Capitalist	1250 Taylor.
305	HALL, EDWARD F., JR.	Stock Broker	410 California.
255^{8}	HALLIDIE, A. S.	Salesroom and Office	6 California.
255^{6}	HALLIDIE, A. S.	Wire & Wire Rope Manuf'y,	Vallejo & Sansome.
255^{4}	HALLIDIE, A. S.	Residence	1026 Washington.
2037	HALL, EDWARD F. JR	Residence	915 Leavenworth.
258	HALE, WM. F	Physician	520 Kearny.
2039	HALE, W. F	Physician	Residence 516 Taylor.
177	HANSEN, C. R. & Co.	Employment Agency	624 and 626 Clay.
292	HARTFORD FIRE INS. Co.		313 California.
5023	HASBROUCK, H. C.	Commanding Post	Presidio.
221	HASTE & KIRK	Coal and Iron	21 Beale.
284	HATCH & BARCLAY	Shipping and Commission	20 California.
253	HATHAWAY, E. V	Rincon Pt. U.S. Bn'd War'se.	Spear and Bryant.
253	HATHAWAY'S U. S. BONDED WAREHOUSE.	E. V. Hathaway	Spear and Bryant.
154^{2}	HAWLEY, MARCUS C. & Co.	H'dw'e and Ag'lt'l Imp'm'ts.	Beale and Market.
154	HAWLEY, MARCUS C. & Co.	" " " "	Bluxome, bet. 4th and 5th.
67^{2}	HECHT BROS. & Co.	Boots and Shoes	528 Market.
2018	HECHT, M. H	Residence	1201 Van Ness Ave.
210m	HEALTH OFFICE	City and County	124 Geary.
6013	HEISTER, A. C	Residence	210 San Jose Ave.
5032	HENDERSON, JNO. JR.	Coal Dealer	117 O'Farrell.
324	HENTRICH & THYARKS	Provision Packers	513 and 515 Front.
	HERRMANN, C	Hats and Caps	336 Kearny.
	HERRMANN, C	Hats and Caps	910 Market.
194	HEYWOOD BROS. & Co.	Manufactures of Chairs.	589, 591, 593 and 595 Mission cor. 2d.
78^{4}	HIESTER, A. C	Stock Report	S. F. Stock Exchange B'ldg.
	HIGGINS & COLLINS	Wood and Lumber	Beale St. Wharf.
	HIGGINS & COLLINS	Wood and Lumber	East and Market.
4012	HINCHMAN, T. W	Residence	2237 Jackson.
225	HINCKLEY, SPIERS & HAYES.	Fulton Iron Works	207-213 Fremont.
2042	HIRSCHFELDER, JOS. O	Physician	1326 Geary.
247	HOBART, WOOD & Co.	Boots and Shoes	15 Sansome.
137	HOBBS, POMEROY & Co	Box Factory	11 and 13 Beale.
6005	HOBBS, CARLTON	Residence	Liberty St.
60	HOCHKOFLER, R	Merchandise Broker	205 Front.
5067	HOCHSTADTER, E	Residence	320 Geary.
287	HOFFMAN, SOUTHARD	Clerk U. S. Dist. Court	Room 14, U. S. Court Bldng.
5^{7}	HOIN, P. P. JR	Supt. Carrier's Dept. P.O.	1332 Sacramento.
5023	HOLABIRD, S. B.	Chief Quartermaster	Presidio.
159^{2}	HOLBROOK, MERRILL & STETSON,	Stoves, Metals & Tinware,	113 California St.
159	HOLBROOK, MERRILL & STETSON,	Warehouse	Battery & Commerce.
308	HOLT BROS	Hard Wood, Lumber and Carriage Materials.	27 to 33 Beale.
302	HOOKER, JOHN D	Agent Hall's Safe and Lock Co.	537 Market.
3059	HOPKINS, E. W	Residence	731 Sutter.
2024	HOPKINS, W. S	Residence	821 Sutter.

NO.	NAME.	BUSINESS.	LOCATION.
160^{3}	House of Correction		Old San Jose Road.
	Hovey, S. D	Residence	214 Powell.
162	Howland, R. S	Commission Merchant	206 Front.
5042	Hubbard, H. H	Physician	22 Geary.
239	Hudson, H. C	Mustard and Spice Mill	124 Main.
248	Hue, Kai & Co	Shoe Manufacturers	127 Clay.
341^{2}	Hueter Bros. & Co	Pioneer Varnish Works	12 Second.
341	Hueter Bros. & Co	Pioneer Varnish Works	Kansas and 24th.
217	Hume, R. D. & Co.,	Salm'n P'k'rs & Com'n Merchants,	309 and 311 Sacramento.
61	Huntington, Hopkins & Co.	Hardware, Iron, Steel, etc.	2 to 10 Bush.
169	Hutchinson & Mann	Insurance Agency.	N. E. Cor. Sansome and Cal.
2047	Hutchinson, F. W	Residence	1620 Jackson.
2049	Hutchinson, Gen'l C. I	Residence	922 Van Ness Ave.
11^{2}	Howes, E. K. & Co	Woodenware	122 Front.
11	Howes, E. K. & Co	Woodenware	37 Main.
114^{3}	Humboldt Whf. Wareh'se.	J. W. Cox & Co.	Spear, bet. Fol. & Harrison.
160^{4}	Industrial School		Old San Jose Road.
5040	Ingerson, H. H	Physician	323 Geary.
3021	Jackson, Byron	Agricult'l Machine Works	Sixth and Bluxome.
95	Jennings, John	Hooper's So. End Wareh's.	Japan and Townsend.
5044	Jobson, W. G	Wood and Coal	511 and 513 Bush.
314	Jones, S. L	Auctioneers and Com'n Merchants	207 & 209 California.
8004	Jory Bros	Wholes'e Manufs. Fine Shoes,	S. W. cor. V. Ness Av & Fell.
65	Journal of Commerce	Publishers	Clay and Sansome.
250	Justice Mining Co	J. P. Cavallier, Sec'y.	419 California.
3016	Kaplan, Louis	Registrar of Voters	New City Hall.
5028	Kast & Co	Fashionable Shoe Store	756 Market, c. Dupont.
242	Kearney, Peter A	Druggist	501 Folsom.
3005	Keil, F. C	Druggist	4th and Market.
112^{2}	Kellogg & Carvell	Lombard Warehouse	Lombard & Sansome.
5023	Kelton, J. C	Ass't Adj't General	Presidio.
70	Kennedy, M. A	Standard Theatre	Bush St.
5049	Kenyon, C. G	Physician	664 Mission.
205	Keogh, John	Curled Hair and Upholstery Materials	73 and 75 New Mont.
193	King of William, C. James & Co,	Manufacturers of Hermetically Sealed Goods.	Broadway & Sansome.
	Kirkpatrick, Jno	Chief of Police	331 Fell.
	Kittle & Co	Office	212 California.
143	Knox, Geo. T	Notary Public	444 California.
3057	Knox, John F	Cal. Wool Depot	Townsend, bet. 5th & 6th.
3051	Korbel, F. & Bros	Lithographers and Cigar Box Mfrs.	Fifth and Bryant.
3051^{2}	Korbel, F. & Bros	Lithographers & Cigar Bx. Manf.	308 Battery.
325	Koshland, S. & Co	Commission Merchants	228 California.
303	Kullman, Salz & Co	Boots, Shoes and Leather	106 Battery.
166^{2}	Kullman, Salz & Co	Hides	43 Clay.
166^{3}	Kullman, Salz & Co	Boot and Shoe Factory	Drumm and Wash.
80	Ladd, Geo. S	Prest. G. and S. Tel. Co.	222 Sansome.
2008	Ladd, Geo. S	Prest. G. and S. Tel. Co	515 Van Ness.
241	Lake & McKoon	Attorneys	310 Pine.
	Lane, Dr. L. C	Physician	652 Mission.

NO.	NAME.	BUSINESS.	LOCATION.
	Lane, Dr. L. C	Physician	Clay and Buchanan.
316	Lane, W. E	Plumber and Gas Fitter	505 Kearny
33	Langley & Co., Chas	Druggists	Front and Pine.
76^{2}	Laven, Col. J. A		30 Sacramento.
7006	Lavenson & Winter	Bay Soap & Candle Works.	South San Francisco.
152^{2}	Lavery, J. V.,	Supt. North Point Dock Grain Warehouse,	Sansome & Chestnut.
338	Lawton, O. & Co	Crockery and Glassware	609 Market.
1^{2}	Lebenbaum L. & Co	Grocers	529 Kearny.
1^{3}	Lebenbaum, Goldberg & Co.	Grocers	California and Polk.
317	LeCount Bros.	Stationers, Printers, Blank Book Manfrs.	417 & 419 Montg.
26^{2}	Leipnitz & Co	Druggists	236 Sutter.
	Lemos Shirt Factory	L. Lemos, Prop'r	1007 Stockton.
	Lemos Shirt Factory	L. Lemos, Prop'r	613 Kearny.
2054	Lennart, Mrs. E. W	Residence	817 Bush.
5034	Levison	The Tailor	733 Market.
5055	Levison	The Tailor	323 Montgomery.
307	Levy, Jos. H	Jeweler	617 Washington.
6	Levy, S. W	Boots and Shoes	115 and 117 Hayes.
6^{2}	Levy, S. W	Boots and Shoes	29 and 31 Battery.
3042	Lewitt, Wm	Physician	Office & Res. 16 Turk.
180	Lick House	Geo. Schoenwald, Manager.	Mont. and Sutter.
152^{3}	Lick Trust		606 Montgomery.
315	Litchfield, J. M. & Co	Merchant Tailors	415 Montgomery.
148	Lloyd & Newlands	Attorneys	13 Nevada Block.
112^{2}	Lombard Warehouse	Kellogg & Carvell	Lombard & Sansome.
124	Loomis, Geo	Plaza Stores	706 to 716 Kearny.
123	Loomis, Geo	Residence	Palace Hotel.
260	Low, C. Adolphe & Co	Gen'l Commis'n Merch'nts.	208 California.
307	Lowenthal, H. H	Attorney-at-Law	411½ California.
111^{2}	Lowry & Co	Commission Merchants	Clay & Davis.
42	Lusk, A. & Co	Wholesale Fruit Dealers	534 and 536 Clay.
192	McAllisters & Bergin.	Attorneys	38 Nevada Block.
187^{2}	Macdonough, J	Coal	25 Market.
187	Macdonough, J	Coal	121 Folsom.
81	Macondray & Co	Shipping and Commission.	204 Sansome.
174^{2}	Madison & Burke	Real Estate Agents	501 Montgomery.
174	Madison, J. H	Residence	206 Stockton.
5053^{2}	Marks, S	Residence	Room 128 Lick House.
86^{3}	Marriott, F	Publisher	609 Merchant.
86	Marriott, F	Publisher	2307 Jones.
6004	Marshall, Benjamin	Physician	S. W. cor. 21st & Valencia.
304	Martenstein & Deming	National Flour Mills	Battery and Pacific.
144^{2}	Mastick, Belcher & Mastick,	Attorneys	520 Montgomery.
5002	Maxwell, R. T	Physician	135 Kearny.
24	Mayhew, Earnest & Co	Grain	302 Davis.
3053	McBride, Jas. H	Physician	124 Tyler.
3	McClung, J. W	Residence	1525 Sutter.
281	McComb, Gen'l Jno	Editor, Alta	529 California.
18	McCord, Bridge & Co	Fashion Stables	Ellis, near Mason.
18^{3}	McCord, Bridge & Co	St. Lawrence Stables	212 Sutter St.
3028	McDonnell, J. J	Druggist	6th and Market.

NO.	NAME.	BUSINESS.	LOCATION.
5023	McDowell, Irvin	Major-Gen'l Commanding	Black Point.
14	McKenna & Greany	Commission Merchants	205 Drumm.
285	McLean, Robert A.	Physician	603 Merchant.
46	McMenomy, J. H.	Butcher	California Market.
99	McNear, G. W	Shipping and Commission	20 California.
5066	McNulty, J. M.	Physician	118 Dupont Res. Palace H'l.
5029	McNutt, W. F	Physician	808 Bush.
3055	Mechanics' Fair	Pavilion	Eighth and Mission.
9001	Medical College		Cor. Stockton & Francisco.
2010	Meese, Constant	Bay Sugar Refinery	14 Bernard Street.
	Mendocino Lumber Co.	Lumber	Beale St. Wharf.
	Mendocino Lumber Co.	Office	40 California.
289	Merrill, J. C	Residence	14 Stanley Place.
289^{2}	Merrill, J. C. & Co.	Commission Merchants	204 California.
207^{2}	Merry, Faull & Co.	Provision Packers	415 Front.
207	Merry, Faull & Co.	Provision Packers	Black Point.
4007	Meyer, Capt. H. L. E.	Residence	N.W. cor. Webster & Clay.
5054^{2}	Meyer. E.	Eureka Nursery	31 Geary.
5069	Meyer, Wm.	Florist	339 Bush.
9000	Meyers, R. C	Druggist	Powell and Union.
88	Michelssen, Brown & Co.	Pork Packers	Foot of 9th.
40	Michelssen, Brown & Co.	Butchers and Pork Packers	308 Front.
7003	Michelssen, Brown & Co.	Butchers	Butchertown.
5026	Middleton & Farnsworth	Coal	14 Post.
5026^{2}	Middleton & Farnsworth	Coal	718 Sansome.
106	Miller & Eaton	Shipping and Commission	Jackson St. Wharf.
181	Miller & Richard	Type Founders	529 Commercial.
2	Mills, D. O.	Capitalist	Over London & S. F. B'k.
2	Mills, D. O.	Capitalist	Millbrae.
75^{2}	Mining & Scientific Press	Dewey & Co	202 Sansome.
75	Mining & Scientific Press	Dewey & Co.	414 Clay.
326^{4}	Mish, P.	Residence	421 Ellis.
326^{2}	Mish, P. & Son	Millinery and Straw Goods	539 Market.
108	Mission Bay Warehouse	Edward Bangs	Channel and 4th.
	Molera, E. J.	Residence.	1928 Sacramento.
105	Montague, W. W. & Co.	Stoves and Tinware	110 Battery.
139^{3}	Moore, C. W	Physician	652 Market.
2044	Morning Call	Publishers	517 Clay.
35	Morrow, Geo	Hay and Grain	37 Clay.
231	Morton, J. & Co.	Draymen	204 Battery.
3004 m	Morton, J. & Co.	Stables	Ellis and Taylor.
163	Mullan & Hyde	Land Agents	623 Commercial.
202	Murphy, Grant & Co.	Wholesale Dry Goods	Bush and Sansome.
	Murphy, James	Physician	1613 Van Ness Ave.
	Murphy, James	Physician	659 Clay.
327	Muser, Bros.	Laces, Embroideries, etc.	541 Market.
3044	Mutual Ice Co.		357 Tehama.
208^{2} m	Myers, Gilman & Co.	Pacific Box Factory	515 Sacramento.
208^{3} m	Myers, Gilman & Co.	Pacific Box Factory	9th and Harrison.
149	Naphtaly, Freidenrich & Ackerman	Attorneys	426 California.
272	Nast & Greenzweig	Importers of Jewelry	533 Market.

NO.	NAME.	BUSINESS.	LOCATION.
134^{2}	Neustadter Bros.	Importers	Battery and Pine.
134	Neustadter Bros.	Standard Shirt Factory	Gough and Grove.
2045	Neustadter, David	Residence	1016 Sutter.
328	Neville & Co.	Bags, Tents, Awnings, Twines	33 California.
311	Newbauer, Jos.	Coal Dealer	206 Bush.
3008	Newman, Carlton	Prop'r Glass Works	1585 Folsom.
3008	Newman, Carlton	Prop'r Glass Works	King Street.
38	Newton Bros. & Co.	Grocers	204 California.
6012	Newton, Morris	Residence	1026 Twenty-first.
	New York Life Ins. Co.	Alex. G. Hawes, Agent	220 Sansome.
	Nicoll	The Tailor	727 Market.
	Nicoll	The Tailor	18 Kearny.
	Nicoll	The Tailor	505 Montgomery.
5037	Normandie House	Albert Thiesse, Proprietor	919 Stockton.
113^{2}	North Pt. Dk. Free Wareh'e.	J. W. Cox & Co.	Foot Sansome St.
152^{2}	N'th Pt. Dk. Grain Wareh'e.	J V. Lavery, Supt.	Sansome & Chestnut.
3018	Nourse & Mitchell	Overland Frt. Transfer Co.	4th and King.
5059	Nucleus House	D. Stern & Son.	Third and Market.
224	Nutting, Calvin & Son	Pioneer Iron Works	121-123 Fremont.
2060	Nye, A. F.	Residence	1306 California.
2048	Occident Stables	A. Waters	Polk and Geary.
227	Occidental Foundry	Steiger & Kerr	137 First.
118	Occidental Grain Warehouse	Wm. M. Starr	First & Townsend.
214	Occidental Hotel	Chas. L. Wetherbee, Manager	Montgomery & Bush.
89^{2}	Odd Fellows Association	Odd Fellows Building	325 Montgomery.
89^{3}	Odd Fellows Cemetery		Cemetery.
120	Oliver, Wm. Letts	Mining Secretary	Room 13, Safe Deposit Bldg.
93	Olympic Club		119 Post.
5017	Opera Saloon.	Weiss & Feldmann	327 Bush.
59	Oriental Bonded Wareh'e.	Pool & Harris	Brannan and First.
3018	Overland Frt. Trans. Co.	C. P. R. R. Freight Dept.	King Street.
115^{3}	Overland Warehouse	T. W. Floyd & Co.	3d and Townsend.
290 m	Oakland.		
282	Pacific Bank		Sansome and Pine.
269	Pac. Barrel & Keg Factory	Flint, Peabody & Co	Brannan and Seventh.
269^{2}	Pac. Barrel & Keg Factory	Office	408 California.
138 m	Pacific Coast Steamsh'p Co.		10 Market.
261	Pacific Mail S. S. Co.	Dock	First and Brannan.
164^{2}	Pacific Rolling Mills		16 First Street.
164^{3}	Pacific Rolling Mills		Potrero.
208^{2} m	Pacific Box Factory	Myers, Gilman & Co.	515 Sac. and 9th & Harrison.
208^{3} m	Pacific Box Factory		9th and Harrison.
291	Pacific Iron Works	Rankin, Brayton & Co.	127 First.
	Pacific Oil & Lead Works		King bet. 2d and 3d.
166^{2}	Pacific Tannery	Kullman, Wagner & Co.	45 Clay.
146	Pacific Transfer Co.		110 Sutter.
147	Pacific Transfer Co.	C. P. Baggage Office	Oakland Ferry.
288	Pac. U.S. Bonded Wareh'se.	Gower & Gilman	N.E. cor. Broadway & Battery.
13	Pacific Vinegar Works	J. L. Koster	415 Fulton.
90	Pacific Vinegar Works	J. L. Koster	323 Front.
189	Page, Moore & Co.	Commission Merchants	213 Clay.

NO.	NAME.	BUSINESS.	LOCATION.
3026m	PAINTER, EMLEN	Druggist	Clay and Kearny.
3012m	PAINTER, EMLEN	Druggist	11th and Mission.
71	PAINTER & CO	Electrotypers & Stereotypers	510 Clay.
2033	PALMER, GEO. H	Physician	424 Post.
280	PARROTT & CO	Merchants	306 California.
6011	PATRICK, A. B. & CO	Tanners	Eighteenth & Folsom.
3055	PAVILION		8th and Mission.
333	PAYOT, UPHAM & CO	Stationers and Printers	204 Sansome.
3039	PEASE, G. M	Physician	125 Turk.
2031	PEASE, R. H. JR	Agt. Goodyear Rubber Co.	Residence 1401 Sutter.
226	PENDERGAST & SMITH	Ætna Iron Works	217 Fremont.
77	PHILLIPS, CAPT. WM. A		Folsom St. Wharf.
210^3 m	PEST HOUSE		San Bruno Road.
3058	PETIBEAU, E	Druggist	Howard and Ninth.
44^2	PICKERING, L	Publisher	517 Clay.
44	PICKERING, L	Publisher	1018 Bush.
330^2	PIKE, J. M	United States Restaurant	548 Clay.
224	PIONEER IRON WORKS	Calvin Nutting & Son	121-123 Fremont.
4006	PIXLEY, F. M	Residence	Union and Fillmore.
176	PLUM, CHAS. M. & CO	Furniture and Carpets	641 Market.
	POHEIM, J	Tailor	203 Montgomery.
	POHEIM, J	Tailor	103 Third.
79	POLICE STATION	Chief of Police Office	Old City Hall.
130	POLICE STATION	Harbor Police	522 Davis.
3006	POLICE STATION		Fifth and Clementina.
3025	POLICE STATION		Howard & Sevent'nth.
3000	POLICE STATION		961 Mission.
129	POLICE STATION		247 Stewart.
3019	POLICE STATION		New City Hall.
37	POLY, HEILBRON & CO	Butchers	339 Kearny.
7002	POLY, HEILBRON & CO	Butchers	Butchertown.
59	POOL & HARRIS	Oriental U.S. Bon'd Wareh'e	Brannan and First.
254^2	PORTER, OPPENHEIMER, SLESSINGER & CO.	Boots & Shoes	117 Battery.
254	PORTER, OPPENHEIMER, SLESSINGER & CO.	Boots & Shoes	Clay and Sansome.
5^6	POST OFFICE	Central Office	Washing'n & Battery.
5^2	POST OFFICE	Station A	1305 Polk.
8^3	POST OFFICE	Station B	7th and Market.
8^4	POST OFFICE	Station C	20th and Mission.
	PRESTON & MCKINNON	Lumber Dealers	Pier 5, Stewart.
	PRESTON & MCKINNON	Lumber Dealers	Bryant and Main.
215	PRESCOTT, SCOTT & CO	Union Iron Works	First and Mission.
5023	PRESIDIO	Military Reservation.	
5036	PROSEK, J	Physician	Office, O'Farrell & Dupont.
8005	PROSEK, J	Physician	Residence, 418 Van Ness.
	QUONG YEE	Chinese Merchant	828 Dupont.
	QUONG YEE	Chinese Merchant	408 Merchant.
	QUONG YEE	Chinese Merchant	410 Kearny.
171	RAIMOND, R. E	Residence	1112 Stockton.
329	RAYMOND & WILSHIRE	Safes and Scales	215 & 217 California.
	REED, GEO. W	Residence	1527 Sutter.
4	REDINGTON & CO	Druggists	529 Market.

NO.	NAME	BUSINESS.	LOCATION.
3016	REGISTRATION Office	Louis Kaplan	New City Hall.
57	RENTON COAL CO	Coal	28 Sacramento.
58^2	RENTON COAL CO	Coal	Geary and Mason.
58^3	RENTON COAL CO	Coal	Sutter and Larkin.
121^2	REYNOLDS, THOS. H	County Clerk	Old City Hall.
110	REYNOLDS, THOS. H	County Clerk	New City Hall.
121^3	REYNOLDS, THOS. H	Residence	628 Washington.
336	RIEGER & CO	Mfrs. Flavoring Extracts, etc.	511 Front.
5062	ROSENSTIRN, JULIUS	Physician	312 Stockton.
283	ROSSBACH, H	Prop. S. F. Pkg. & Prov. Co.	517 & 519 Washington.
2055	ROY, ROBERT	Residence	1016 Vallejo.
309	RUED, J. C	Leather	34 Clay.
2060	RICHTER, C. MAX	Physician	126 Kearny, Thurlow Block.
100	RIDER, SOMERS & CO	Hay and Grain	Pier 22 Stuart.
179	RILEY & VEST	Grain & Com'sion M'ch'ts	507 East.
253	RINCON POINT U. S. BONDED WAREHOUSE	E.V. Hathaway	Spear and Bryant.
236	RISDON IRON AND LOCOMOTIVE WORKS		Howard and Beale.
173	ROCHE & DESBECK	Attorneys at Law	R'ms 30,31 & 32 Mont. Blk.
219	RODGERS, MEYER & CO		212 Battery.
2016	ROMA, J. M	Residence	708 O'Farrell
251	ROSENSTOCK, S. W. & CO.	Boots and Shoes	S. E. cor. Sansome & Bush.
240	ROSSETER & SMITH	Leather and Shoe Findings	545 Market.
8003	RULE, F. K	Residence	702 McAllister.
5025	RUSS HOUSE	S. H. Seymour & Co., P'rs.	Montgomery Street.
4005	SABIN, JNO. I	Supt. G. & S. Tel. Co.	1812 Pierce.
298	SABIN, JNO. I	Supt. G. & S. Tel. Co.	222 Sansome.
5005	SALFIELD, C. D	Physician	34 Kearny.
3053^2	SANBORN, VAIL & CO	Pictures, Frames, etc.	871 Market.
330	SANDERSON & HORN	Mfrs. Cigars, Imptrs., Jobbers Tobacco.	327-329 Front.
270	SCHWEITZER, SACHS & CO.	Importers	521 Market.
270	SCHWEITZER, SACHS & CO	Importers	25 and 27 Battery.
270^2	SCHWEITZER, SACHS & CO		321 Market.
5038	SIMPSON, JAS	Physician	234 Post.
5052^2	S. F. CHRONICLE	Business Office	Bush and Kearny.
5052	S. F. CHRONICLE	Editorial Rooms	Bush and Kearny.
208 m	S. F. CANDLE CO	Office	402 Front.
208^4 m	S. F. CANDLE CO	Works	N. E. Cor. Alameda and Rhode Island.
3046	S. F. CARPET BEATING MACHINE	S. McDowell & Co.	1321-1323 Market.
246	SAN FRANCISCO GAS LIGHT CO.		Cor. First & Natoma.
142	S. F. LAW LIBRARY		27 & 28 Montg'y Bl'k.
86^5	S. F. NEWS LETTER	Publishers	609 Merchant.
283	S. F. PACKING AND PROVISION CO.	H. Rossbach, Propr	517-519 Washington.
245	S. F. AND NORTH PACIFIC R. R. CO.	Peter Donahue, Pres.	426 Montgomery.
3008	S. F. & PACIFIC GLASS WK'S	C. Newman	King St.
106	S. F. STEAMBOAT & TRANSPORTATION CO.	Miller & Eaton, Agts	Jackson St. Whf.
5041	S. F. TEN CENT PARCEL DELIVERY		16 Post.
107	SCANNELL, D	Chief Engineer Fire Dept.	Old City Hall.
145^3	SCHLUETER & VOLBERG	Carpets	709 Market.
	SCHMITT, MAURICE	Residence	Sutter and Gough.
101	SCOTT & MCCORD	Hay and Grain	Pier 21 Stuart.
2035	SCOTT, H. T	Residence	1822 Sacramento.

NO.	NAME.	BUSINESS.	LOCATION.
235	Scott, Irving M	Residence	507 Harrison.
3010	Searby, Wm. M	Druggist	869 Market.
128	Seattle Coal and Transportation Co.		30 Market.
150	Shattuck & Fletcher	Print'g & Lithogr'ph'g Inks.	520 Com'l.
5000	Sherman & Hyde	Music Store	Sutter and Kearny.
2038	Shorb, J. C	Physician	407 Post.
5006	Sims, Harry L	Physician	703 Market.
3004	Slaven, H. B	Druggist	Market and Powell.
2025	Slocum, Lot D	Excelsior Stables	921, 923, 925 Sutter.
172 m	Sloss, Louis & Co.	Hides, Wool and Furs	310, 312 Sansome.
172^{2}	Sloss, Louis & Co.	Warehouse	Townsend and 3d.
230	Smith, Francis & Co.	Manufs. Sheet-Iron Pipe	130 Beale.
256^{2}	Smith, F.	Money Broker	316 Montgomery.
5045	Smith, Wm. F., M. D.	Oculist	313 Bush.
2061	Smedberg, W. R.	Residence	1611 Larkin.
95	South End Grain Wareh'se.	Jno. Jennings	Japan and Townsend.
3011	South Point Warehouse	T. G. Walkington	Berry, bet. 3rd & 4th.
7013	South San Francisco Packing and Provision Co.		4th Ave & M. St.
3040	Spaulding, John & Co.,	Pioneer Carpet Beat'g Mach.	353 Tehama.
114^{2}	Sperry & Co.	Commission Merchants	22 California.
91 m	Splivalo, C. R.	Cal. Italian Paste Co.	704 Sansome.
92 m	Splivalo, C. R.	Cal. Italian Paste Co.	6th and Berry.
222	Spring Val. Water Works	General Office	516 California.
222^{2}	Spring Val. Water Works	Yard	Bryant and Fourth.
5024	St. George Stables	A. B. Butler	Bush, above Kearny.
18^{3}	St. Lawrence Stables	McCord, Bridge & Co.	212 Sutter.
18^{3}	St. Lawrence Stables	Livery	212 Sutter.
12	Stallard, J. H.	Physician	37 Post.
70	Standard Theatre	M. A. Kennedy	Bush St.
118	Starr, Wm. M	Occidental Grain Wareh'se.	First & Townsend.
118^{2}	Starr & Co.	Flour and Grain	16 California.
2026	Staub, H	Druggist	Sutter and Larkin.
227	Steiger & Kerr	Occidental Foundry	137 First.
331	Steinhart, W. I. & Co.	Clothing, Furnishing Goods	3 and 5 Battery.
2057	Stevenson, Col. J. D	Residence	2109 Van Ness Ave.
204	Stevenson, Col. J. D.	U. S. Shipping Com'r	118 Jackson.
212	Strauss, Levi & Co	Importers of Dry Goods, Clthng and Frnshng Goods.	14 and 16 Battery.
200	Stuart, Wm	Mining Secretary	12 Halleck Building.
262	Surveyor-General's Office	Theo. Wagner	610 Commercial.
216	Swain, J. H.	Livery Stable	417 Folsom.
102 m	Swan, G. W. & Co	Box Factory	114 Spear.
103 m	Swan, G. W. & Co	Box Factory	416 Davis.
5027	Swan the Painter		727 Market.
249	Taber, Harker & Co.	Wholesale Grocers	108 and 110 Cal.
5001	Taber, I. W. & Co.	Photographic Art Gallery	8 Montgomery.
83	Tay, Geo. H. & Co.	Stoves and Tinware	614 Battery.
165^{2}	Taylor, F. B. & Co.,	Imp'trs and Com'sion M'ch'ts	120 Front.
62	Taylor, John & Co.	Druggists' Glassware	512 Washington.
78^{3}	Taylor, Jno. W	Gutta Percha	501 Market.
6009	Taylor, F. B	Residence	2422 Howard.

NO.	NAME.	BUSINESS.	LOCATION.
111^{5}	Tenney, Richard P.	Commission	Market & Davis.
139	Terminus Drug Store.	Abramson & Bacon	Sutter & Dupont Sts.
232^{2}	Tevis, Lloyd.	Capitalist	Sansome and Cal.
5016	Thayer, B. B.	Chemist, Apothecaries Hall.	Under Grand Hotel.
	Thayer, B. B.	Residence	800 Ellis.
206	The Commercial Agency	Edwards, Pickens & Fulton.	401 California.
98	Tillman & Bendel	Grocers	407 Clay.
9001	Toland Medical College		Stockton and Pfeifer.
153	Tomkinson, James	Livery, Hack & Sale Stable.	57, 59 & 61 Minna.
5031^{2}	Townsend, W. S	Palace St'm Candy Fact'y.	627 Market.
5031	Townsend, W. S.	Br'ch Palace Candy Fact'y.	203 Kearny.
4017	Traylor, W. W	Residence	Broadway & Webster.
6008	Truman, I. J	Residence	812 Twentieth.
8002	Trumpour & Christenson	Dentists	2021 Mission.
8002	Trumpour, J. P.	Dentist	401½ Hayes.
218	Tubbs & Co.	S. F. Cordage Factory	613 Front.
197^{2}	Underwriters' Fire Patrol		Ecker and Stevenson.
102 m	Union Box Factory	G. W. Swan & Co.	114 Spear.
72	Union Club		California & Montg'y.
215	Union Iron Works	Business office, and connecting with the several dep'ts.	First and Mission.
122^{2}	United Carriage Co.	Hacks and Coupés.	Palace Hotel.
2000^{2}	United Carriage Co.	Hacks and Coupés.	Baldwin Hotel.
2000	United Carriage Co.	Hacks and Coupés.	Sutter & Leavenw'th.
125	U. S. Branch Mint		Fifth & Mission.
	United Workingmen	Boot and Shoe Co.	416 Market.
	United Workingmen	Boot and Shoe Co.	25th and Bartlett.
3053	Vail, A. H	Residence	126 Tyler.
211	Van Winkle, I. S. & Co.	Iron, Steel & C'mberl'd Coal.	413 and 415 Market.
2003	Verdenal, D. F	Mining Secretary	327 Pine.
3014	Vermeil, J. L.	Hay and Grain	608 Fourth.
3014	Vermeil, J. L	Hay and Grain	Berry, bet. 5th & 6th.
6007	Vermeil, J. L	Residence	24th & Harrison.
262	Wagner, Theo.	Surveyor-General	610 Commercial.
2050	Wagner, Theo	Residence	2101 Hyde.
196	Wakelee, H. P. & Co	Druggist	Montgomery & Bush.
311	Walkington, T. G.	South Point Warehouse	Berry, bet. 3rd & 4th.
21	Waldstein, A.	Lithographer	Sac'to and Sansome.
22	Waldstein, A.	Cigar Box Factory	Berry near Sixth.
56	Wangenheim, Sol. & Co.	Packing and Canning	120 Davis.
318	Waterhouse & Lester	Carriage Materials	29 and 31 Fremont.
96	Waterman, M. & Co.	Produce & Com'sn Merch'ts.	111 Clay.
2048	Waters, Arthur	Occident Stable	Geary and Polk.
5033	Waters, Chas.	Plumber	30 O'Farrell.
3041	Weems, J. P. & Co.	Coal Dealers	234 Fifth.
5017	Weiss & Feldmann	Opera Saloon	327 Bush.
23	Wellman, Peck & Co.	Grocers	416 Front.
	Wells, Fargo & Co's Express.	J. J. Valentine, Gen. Supt.	Sansome and Halleck.
	Wells, Fargo & Co's Bank	Lloyd Tevis, Pres.	Sansome & California.
2034	Wells, Geo. R.	Residence	1004 Geary.
302	Wentworth Boot and Shoe Co.	J. D. Hooker	537 Market.

NO.	NAME.	BUSINESS.	LOCATION.
5048	WENZELL, W. T.	Pioneer Apothecary	852 Market.
326^{2}	WERNER, MRS. F	Paris Millinery	708 Market.
265^{2}	WEST COAST FURNITURE CO.	Salesroom	Second and Market.
265	WEST COAST FURNITURE CO	Factory	Fourth and Bryant.
30	WESTERN UNION TEL. CO		Pine & Montgomery.
214	WETHERBEE, CHAS. L	Manager	Occidental Hotel.
2021	WHARTENBY, JAMES	Residence	408 Ellis.
197^{2}	WHITE, CAPT. RUSSELL	Fire Patrol	Stevenson.
	WHITE, CAPT. RUSSELL	Residence	174 Jessie.
256^{2}	WHITELAW, THOS. P. H	Ship Chandler	Foot of Second.
256	WHITELAW, THOS. P. H.	Residence	401 Bryant.
256^{3}	WHITELAW, THOS. P. H.		316 Montgomery.
243	WHITNEY & CO'S EXPRESS.	Oakland, Alameda, Brooklyn, Berkeley, Temescal	3 and 5 Commercial.
294	WHITNEY & MARSHALL	Iron and Coal Merchants	22 and 24 Fremont.
3003	WHITNEY & WEBSTER	Wool Warehouse.	King St.
2023	WHITNEY, J. P	Physician	204 Sutter.
2022	WHITNEY, J. P	Physician	1007 Sutter.
	WHITNEY, J. D	Physician	204 Sutter.
	WHITNEY, J. D	Physician	Lick House.
106	WIENER, E. O	S. F. Steamboat and Transportation Co.	Jackson St. Wharf.
55	WILLIAMS, BLANCHARD & CO.	Agents P. M. S. S. Co.	218 California.
261	WILLIAMS, BLANCHARD & CO.	Dock	First and Brannan.
190	WILSON & WILSON	Attorneys	420 California.
84	WILSON, J. Y. & CO	Provision Packers	508 Market,
94	WILSON, J. Y. & CO	Provision Packers	Buchanan and Bay
4008	WILSON, JNO. SCOTT	Residence	2416 Washington.
44	WILSON & HUTCHINSON	Stock Brokers	322 Pine.
5057	WINDELL, H	Pioneer Furniture Wareh'e.	310 Stockton.
27	WINDSOR HOUSE	Warschauer Bros.	905 Market.
8006	WINTERHALTER, W.	Residence	1430 Tyler.
5021	WORTH, SIDNEY	Physician	426 Sutter.
3000	WOOD, F.	Residence	2923 Sacramento.
332	WOOSTER, HUBBELL & CO.	Wholesale Provisions	317 and 319 Front.
184^{2}	YATES & CO	Paints and Oils	113 Front.
220	YATES, R. R	Sell. Agt. Cal. Silk M'f'g Co.	585 Market.
184	YATES & CO	Oil Warehouse	223 Main.
	ZELNER, WM	Druggist	5th and Mission.

Armories.

NO.	NAME.		LOCATION.
281^{2}	HEAD QUART'RS 2ND BRIGADE.	Brig. Gen. John McComb	523 Pine.
266^{3}	CAVALRY ARMORY	Maj. R. H. Orton	New Montg. & Minna.
266^{3}	ARMORY LAGRANDE		New Montg. & Minna.
266^{2}	FIRST REGIMENT N. G. C.	Col. Oscar Woodhams	N. W. cor. N. Mont. & Howard
5039	SECOND REGIMENT N. G. C.	Col. W. R. Smedberg	420 Post.
266^{4}	THIRD REGIMENT N. G. C.	Col. A. Wason	N. E. cor. N. Mont. & Howard.
5039	CO. G. 2ND REG'T N. G. C.	Capt. L. W. Mix	420 Post.
5039	CO. B. 1ST REG'T N. G. C.	Capt. J. H. Dickinson	420 Post.
5014	COS. C. AND D. 2ND REG'T N. G. C		310 O'Farrell.
5035^{2}	CO. F. 2ND REG'T N. G. C.	Capt. F. W. Bacon	Sutter and Powell.

Attorneys-at-Law.

For Telephone Number, refer to Alphabetical List in front.

BARNES, W. H. L.		426 California.
FLOOD, NOAH F.		1904 Laguna.
GALLAGHER, THOS. J.		602 Commercial.
GREATHOUSE & BLANDING		324 Pine.
HAGGIN, J. B.		51 Nevada Block.
KNOX, GEO. T.	Notary Public	444 California.
LAKE & McKOON		310 Pine.
LLOYD & NEWLANDS		13 Nevada Block.
LOWENTHAL, H. H		411½ California.
MASTICK, BELCHER & MASTICK		520 Montgomery.
McALLISTERS & BERGIN		38 Nevada Block.
NAPHTALY, FREIDENRICH & ACKERMAN		426 California.
ROCHE & DESBECK		30 Montgomery Block.
WILSON & WILSON		420 California.

Coal Dealers.

For Telephone numbers see Alphabetical List in front.

ALLEN, C. R.	120 Beale.
BARNARD, F. & CO	East and Jackson and 213 Jackson.
EBBETTS, A. M	109 Sacramento.
HASTE & KIRK	21 Beale.
HENDERSON, JNO., JR	117 O'Farrell.
JOBSON, W. G	511 Bush.
MACDONOUGH, J	25 Market & 121 Folsom.
MIDDLETON & FARNSWORTH	14 Post and 718 Sansome.
NEWBAUER, JOS.	206 Bush.
RENTON COAL CO	28 Sacramento, Sutter and Larkin, Geary and Mason.
WEEMS, J. P. & CO	234 Fifth.
WHITNEY & MARSHALL	22 and 24 Fremont.

MEDICAL DIRECTORY.

For Telephone Number, refer to Alphabetical List in front.

Physicians and Surgeons,

CONNECTED WITH THE CENTRAL SYSTEM.

NAME.	OFFICE.	RESIDENCE.
AYER, WASHINGTON	410 Kearny	*1622 Clay.
Office Hours, 8 to 9 a. m., 2 to 4 p. m.		
BAZAN, F	*850 Market	*1633 Mission.
Office Hours at Residence, 11 a. m. to 1 p. m. and 4 to 6 p. m.		
BENNETT, THOS	620 Market	*716 Pine.
Office Hours, 2 to 4 p. m.		
BOWERS, J. MILTON	*23 Kearny	Palace Hotel.
Office Hours, 1 to 3 and 7 to 7½ p. m. Sundays, 1 to 2 p. m.		
BOYSON, THOMAS	*112 Kearny	*112 Kearny
Office Hours, 12 p. m. to 2 p. m., 7 to 8 p. m.		
CHISMORE, GEO	*920 Market	*920 Market.
Office Hours, 1 to 3 and 7 to 8 p. m.		
CLARKE, J. J	106 Stockton	106 Stockton.
Office Hours, 11 a. m. to 1 p. m., 7 to 8 p. m.		
COLE, R. BEVERLY	*518 Sutter	*518 Sutter.
Office Hours, 12 to 3 p. m.		
COLMAN, N. B	*204 Sutter, Room 4	1908 Sutter.
Office Hours, 12 to 3 p. m.		
DEANE, C. T	*321 Ellis	*321 Ellis.
Office Hours, 12 to 3:30 and 6 to 7:30 p. m.		
DORR, L. L. (Coronor)	*118 Dupont	2320 Mission.
Office Hours, from 10 a. m. to 12 m., 3 to 5 p. m. At Home, 5:30 p. m. to 9 a. m.		
DOUGLASS, WM. A.	*126 O'Farrell	*126 O'Farrell.
Office Hours, 1 to 3 and 7 to 8 p. m.		
ECKEL, J. N	*324 Geary	*324 Geary.
Office Hours, 12 a. m. to 1 p. m., 6 to 7 p. m.		
FLETCHER, C. A.	23 Kearny	501 Post Street.
Office Hours, 10 to 12 a. m., 2 to 4 p. m.		
FRASER, E. J	*221 Powell	*221 Powell.
Office Hours, 8 to 9 a. m. and 1 to 3 and 6 to 8 p. m.		
HALE, WM. F	*520 Kearny	*516 Taylor.
Office Hours, 2 to 5 p. m.		
HIRSCHFELDER, JOS. O	126 Kearny	*1326 Geary.
Office Hours, 1 to 3 p. m. Sundays, 10 to 11 a. m.		
HUBBARD, H. H	*22 Geary	*22 Geary.
Office Hours, 12 to 3 p. m.		

* A star indicates the location of Telephone, whether at Residence, Office, or both.

NAME.	OFFICE.	RESIDENCE.
INGERSON, H. H	*323 Geary	*323 Geary.
Office Hours, 9 to 10 a. m., 4 to 6 and 7 to 8 p. m.		
KENYON, C. G. S	664 Mission	
Office Hours, 1 to 3 and 7 to 8 p. m.		
LANE, L. C	*652 Mission	*Clay and Buchanan.
Office Hours, 1:30 to 4 p. m. At Home, 7 to 8 p. m.		
LEWITT, WM	*16 Turk	*16 Turk.
Office Hours, 1 to 3 p. m., and in the Evening.		
MARSHALL, BENJAMIN		*904 Post.
Office Hours, 10 a. m. and 8 p. m.		
MARTIN, W. N	23 Kearny	Oakland.
Office Hours, 12 to 4 p. m.		
MAXWELL, R. T	*135 Kearny	*135 Kearny.
Office Hours, 2 to 5 p. m., and in the evening.		
McBRIDE, JAMES H	124 Tyler	124 Tyler.
Office Hours, 12:30 to 3 p. m.		
McLEAN, ROBT. A	603 Merchant	
Office Hours, 9 a. m., 1 to 4 and 7 to 9 p. m.		
McNULTY, J. M	*118 Dupont	*Palace Hotel.
Office Hours, 9 to 10 a. m. 1 to 3 p. m. At Hotel after 5 p. m.		
McNUTT, W. F	121 Montgomery	*808 Bush.
Office Hours, 12 to 3 and 7 to 8 p. m.		
McRAE, A	*25 Kearny	Oakland.
Office Hours, 2 to 4 and 7 to 8 p. m.		
MEDICAL COLLEGE		*Cor. Stockon & Francisco.
MOORE, C. W	*652 Market	*652 Market.
Office Hours, 8 to 10 a. m. 12 to 4 and 8 to 10 p. m.		
MURPHY, JAMES	*659 Clay	*1613 Van Ness.
Office Hours, 8 to 9 a. m., 1 to 3 and 7 to 9 p. m.		
PALMER, GEO. H	*424 Post	*424 Post.
Office Hours, 8 to 10 a. m. 3 to 4 and 7 to 8 p. m.		
PEASE, G. M	*125 Turk	*125 Turk.
Office Hours, 1 to 4 p. m.		
PROSEK, J	*O'Farrell and Dupont	*418 Van Ness.
Office Hours, 12 to 2 and 7 to 8 p. m. Sundays, 11 to 12.		
RICHTER C. MAX	*126 Kearny (Thurlow Block)	*126 Kearny.
Office Hours, 12 to 2 and 7 to 8 p. m.		
ROSENSTIRN, JULIUS	312 Stockton	312 Stockton.
Office Hours, 1 to 3 and 7 to 8 p. m.		
SHORB, J. C	*407 Post	*407 Post.
Office Hours, 8 to 9 a. m., 3 to 5 and 7 to 8 p. m.		
SIMPSON, JAS	*234 Post	814 Sutter.
Office Hours, 9 a. m., 1 to 3 and 7 to 8 p. m.		
SIMS, HARRY L	*703 Market	*703 Market
Office Hours, 1:30 to 4 p. m.		

* A star indicates the location of Telephone, whether at Residence, Office, or both.

NAME.	OFFICE.	RESIDENCE.
SMITH, WM. F.	*313 Bush.	*313 Bush.
	Office Hours, 12 to 4 p. m.	
STALLARD, J. H.	*37 Post.	*37 Post.
	Office Hours, 12 to 3 and 7 to 8 p. m.	
WHITNEY, J. P.	*204 Sutter.	*1007 Sutter.
	Office Hours, 3 to 5 p. m.	
WHITNEY, J. D.	*204 Sutter.	*Lick House.
	Office Hours, 9 to 10 a. m. 12 to 2 and 7 to 8 p. m.	
WORTH, SIDNEY	*426 Sutter.	*426 Sutter.
	Office Hours, 8 to 9 a. m. 2 to 4 and 6 to 7½ p. m.	

* A star indicates the location of Telephone, whether at Residence, Office, or both.

Druggists.

For Telephone Number, refer to Alphabetical List in front.

ABRAMS & CARROLL.......3 and 5 Front.
ABRAMSON & BACON.......Sutter and Dupont.
ABRAMSON & BACON.......717 Clay.
BAYLY, CHAS. A.......Sixth and Howard.
BERGER, C. F.......Eddy and Steiner.
BRYAN, W. J.......Apothecaries Hall, under Grand Hotel.
BURNETT, G. G.......327 Montgomery.
BURT & Co.......California and Fillmore.
COFFIN & MAYHEW.......Mission and 20th.
CRANE & BRIGHAM.......520 Market.
DEVINE, JAMES.......214 Kearny.
EVANS, A.......Hayes and Laguna.
KEARNEY, PETER A.......First and Folsom.
KEIL, F. C.......Market and 4th.
LANGLEY, CHAS. & CO.......Pine and Front.
LEIPNITZ & CO.......236 Sutter.
MEYERS, R. C.......Powell and Union.
McDONNELL, J. J.......Market and 6th.
PAINTER, EMLEN.......Clay and Kearny.
PAINTER, EMLEN.......Misson and 11th.
PETIBEAU, E.......Howard and 9th.
REDINGTON & CO.......529 Market.
SEARBY, WM. M.......869 Market.
STAUB, H.......Sutter and Larkin.
SHAW'S PHARMACY.......Sutter and Powell.
SLAVEN, H. B.......Market and Powell.
TAYLOR, JNO. & CO., Druggists' Glassware.......512 Washington.
WAKELEE, H. P. & CO.......Montgomery and Bush.
WENZELL, W. T.......852 Market.
ZELNER, WM.......Mission and 5th.

H. H. ELDRED, Esq. GENERAL MANAGER, NEW YORK. | G. T. WILLIAMS, Esq. DIST. SUPERINTENDENT, CINCINNATI, O.

EDISON TELEPHONE

EXCHANGE,

OF

DAYTON, O.

CENTRAL OFFICE, Above Winters & Son's Bank, NORTH MAIN STREET.

G. W. HOGLEN, Manager.

OPERATED BY THE

WESTERN UNION TELEGRAPH COMPANY.

First Instrument Operated in this City, September 1, 1879.

DIRECTIONS.

To call Central Office, press the button four or five times slowly, and wait for an answer by your bell. If not answered promptly, repeat; when answered, take your Telephone from the switch and retain it near the ear until through conversation. When your signal is answered place your mouth *near* the Transmitter, *not into it*, and *always* first give your name or number assigned you on this list, next the name or number of party wanted, for we must be able to announce party calling to party wanted. A strict observance of this rule will avoid delays and prevent mischievous mistakes.

For example: "Hello," "Good morning," or "Good evening" Exchange, "500, or Charlie Foster wants 100, or Thos Ewing."

While Exchange is finding party wanted the caller will be disconnected temporarily, and we are not responsible for delays at this point. Wait patiently two or three minutes, *if necessary*. If then not answered, return telephone to switch and call again, *remembering the bell can not be rung* from Exchange *when switch is open*. Always speak slowly and distinctly, in a moderate and natural tone of voice.

When Central Office calls you, *do not press button in answer*. Simply take Telephone from switch and ask what is wanted.

When through conversation, replace Telephone on switch and always press the button *three times* for disconnection. A neglect to notify us may delay your own business as well as ours, through parties being told you are engaged.

CAUTION.

Your Instrument should be placed in a locality from where the bell can be heard at all times, and when parties retire for any length of time from place of business or residence, the Exchange and your correspondents will be accommodated if you advise us as to the hour of retiring and return.

Keep your Instrument free from dust and moisture. When through conversation wipe out mouth-piece and turn it down to avoid collection of dust.

When you withdraw Telephone from switch for conversation, be certain to have switch *fully open*. This is often neglected, and prevents transmission.

EDISON TELEPHONE EXCHANGE.

LIST OF SUBSCRIBERS

CONNECTED WITH THE

CENTRAL OFFICE,

NOVEMBER 1, 1879.

Call Number.	Names. Location.	Business Hours A. M.	P. M.
109	A & G W R R Depot, cor First and Keowee	7 00 to	6 00
514	American Express Co., Third near Jefferson	7 00 to	6 00
213	Alabaugh, Crume & Co., cor Fourth & St. Clair	7 00 to	10 00
118	Anderton, Charles, Third near Jefferson	4 00 to	11 00
122	Abbey, James, Main street	6 00 to	10 00
429	Ackelson, Dr., cor Fifth and Ludlow	All hours.	
522	Bradstreet & Sons, Fourth near Jefferson	7 00 to	9 00
510	Buckeye Brass Works, Third and Wyandott	7 00 to	6 00
117	Barney, Smith & Co., Car Works	7 00 to	6 00
333	Bauman, A L, west Third street	6 00 to	11 00
313	Bright & Crossley, Third and St. Clair	7 00 to	9 00
530	Best, W H & Co., Third and Main	6 00 to	10 00
110	Bretch & Evans, Third and Wyandott	6 00 to	9 00
501	Barlow Clothing House, Main and Second	6 00 to	9 00
235	Bellville, W, Third, bet Main & Jefferson	7 00 to	11 00
202	Bowden, J A & Co, 134 e Second	6 00 to	9 00
240	Brown, S N & Co, Fourth and St Clair	7 00 to	6 00
317	Barnett, R & Co, Wayne near Fifth	7 00 to	9 00
540	Brown, S N, s Wayne	All hours.	
413	Boyer & McMaster, store, Third near St. Clair	7 00 to	6 00
524	Boyer & McMaster Foundry. Bayard st.	7 00 to	6 00
239	Bellville, W J & J J, 6 s Main	8 30 to 1 30 to	12 30. 5 30.
324	Brown, O B, office, 17 e Third	8 00 to	6 00.
436	Bright, J B, residence	7 00 to	10 00
335	Boltin & Shauck, cor Main and Second	8 00 to	6 00.
142	Brinkle, H, e Fifth st		
219	Beckel & Pohlmeyer, 267 Fifth st, Restaurant	6 00 to	12 00.
306	C C C & I R R Freight Depot	All hours.	
499	Callahan, W P, Third, near canal	7 00 to	6 00.
505	Cotterill, Fenner & Co, 113 Second	7 00 to	6 00.
209	Conover & Hayden	6 00 to	9 00.
318	Cathcart, James	All hours.	

Call Number.	Names. Location.	Business Hours. A. M. P. M.
215	Croy, McFarland & Co, cor Sixth and Main	6 30 to 6 00.
134	Canby, E, 302 w Water	7 00 to 6 00.
511	Clegg, Wood & Co, Wyandott and Fourth	6 00 to 7 00.
211	Cox, J C, 7 Huston building	9 00 12 00. 2 00 6 00.
433	County Clerk, Court House	8 00 to 6 00.
504	Cain, J C, Public Landing	7 00 to 6 00.
322	City Clerk, City Building	9 00 to 3 00.
430	Chamberlin Chas, office, 13 s Main	7 00 to 6 00.
532	Crossley, Capt, residence, w Second	7 00 to 10 00.
233	City Hospital	7 00 to 8 00.
405	Clark & Co, Second and Canal	7 00 to 6 00.
423	Church, J S, Jefferson st and P O	7 00 to 9 00.
136	Cox, John G, Fourth near P O	6 00 to 9 00.
112	C H & D R R Frt Depot, Webster near Third	All hours.
112	D & M R R Depot, Webster near Third	All hours.
128	D & U R R Depot	All hours.
527	D C & T R R Office	7 30 to 6 00.
114	D & S E R R Office	All hours.
208	Dempsey, Jas, Third and Wyandott	All hours.
229	Dodds, Jas, Main st near Third	7 00 to 9 30.
327	Dickey House, Sixth and Wilkinson	All hours.
223	Dancyger & Sons, Third and Jefferson	7 00 to 9 00.
503	Dickson, W B & Co, First and Sears	7 00 to 6 00.
107	Dennis, G B & Co	8 00 to 6 00.
231	Daugherty, Dr, Coroner	All hours
428	Davis, I, Yard 220 e Fifth	7 00 to 9 00.
437	Davis, I, Branch, cor Perry and Maple	6 00 to 9 00.
506	Dixon, Geo M, cor Main and Second	7 00 to 9 00.
220	Davis, Samuel, cor Fifth and McDonough	6 30 to 6 30.
312	Dayton Plow Works, Upper Hydraulic	7 00 to 6 00.
139	Dayton Law Library, Third bet Main & Jeff'son	7 00 to 6 00
103	Eckwright, Capt F, 131 Commercial	All hours.
235	Elliott, Judge H, Third bet Main and Jefferson	8 00 to 6 00
438	Eversole & Ries, Third bet Main and Jefferson	7 00 to 9 00
310	Farmers Friend Manf'g Co, cor Wayne & State,	7 00 to 6 00.
221	Freeman, W D, Office	8 00 to 12 00. 1 00 to 6 00.
206	Freeman, W D, Residence, Wayne st	All hours.
520	Fritch, Nipgen & Co, Third near St Clair	7 00 to 8 00.
124	Fox, Chas E, Third and Main	7 00 to 10 00.
431	Fellows & Bragg, Third st near Phillips House,	7 00 to 6 00.
326	Fletcher, J R, Fifth and Brown	6 00 to 10 00.
200	Firemans Ins Co, Jefferson bet Second & Third,	8 00 to 5 00.
214	Gebhart, S & Sons, Third and Front	7 00 to 12 00. 1 00 to 5 30.
311	Gebhart, Josiah & Co, Second and Front	8 00 to 12 00. 1 00 to 6 00.

Call Number.	Names. Location.	Business hours. A. M. P. M.
418	Gebhart, J R & Son, Third and Canal	7 00 to 8 00
410	Gebhart, Harman & Co, Third and Jefferson	8 00 to 4 00
432	Gray, T H, Market, Third near Ludlow	All hours.
502	Gibbons & McCormick, Jeff bet Second & Third,	7 00 to 6 00
212	Gimperling, J E, Residence	All hours.
328	Gunckle & Rowe, Office, Main near Third	8 00 to 5 30
316	Gunckle, P, Third bet Main and Jefferson	8 00 to 12 00 2 00 to 9 00
340	Gebhart, Geo, Residence, s Wayne	
237	Hale, Rev J W, German Ref Church, Ludlow st,	8 00 to 12 00 2 00 to 4 00
401	Heathman, G W & Co, cor Second and St Clair,	7 00 to 6 00
528	Hanitch, H, Main st near Third	6 00 to 10 00
315	Humphreys, A, Office, I O O F Temple	7 00 to 6 00
507	Houck, M J, Yard, Wayne near Third	7 00 to 9 00
403	Holden Manf'g Co, Second near Main	7 00 to 10 00
525	Hubbard, L & H, Office, Pruden Block, Fifth st,	7 00 to 7 30
534	Hughes, R D, Residence, 22 Bridge st	7 00 to 10 00
236	Hollingsworth, D S	8 00 to 10 00
119	Hilgefort, H, Store, 142 e Third st	6 00 to 8 00
339	Huber & Lyons, Main bet Third and Fourth	7 00 to 9 00
440	Herman Ezra, residence, s Wayne	6 00 to 10 00
542	Hoglen, G W, residence, 212 w Fifth	6 00 to 11 00
435	Iddings & Iddings, office, 34 n Main	8 00 to 12 30 1 30 to 5 00
435	Iddings, W B, office, 34 n Main	8 00 to 12 30 1 30 to 5 00
140	Italian Band, office, cor Fifth and Jefferson	7 00 to 6 00
302	Journal Office, Main st	All hours.
131	James, H F, Druggist, Third near Main	7 00 to 10 00
533	Jennings, Dr, office, Wilkinson st bet 2d and 3d	7 00 to 8 00 1 00 to 3 00 7 00 to 10 00
523	Jacobs, N & C & Co, n Market st	3 00 to 9 00
508	Jackson Co Coal Office, Third and McDonough	7 00 to 6 00
404	Jewett, Dr H, office, 24 Jefferson	12 00 to 2 00 5 30 to 7 00
424	Johnston, Samuel, Main bet Third and Fourth	7 00 to 11 00
441	Kenney, J T, and J C Seward, 34 s Main	8 00 to 9 00
522	Needham & Shideler, with Bradstreet & Son	7 00 to 9 00
519	Kiefaber Bros, Fruit Depot, 3d bet Jeff & StClair,	7 00 to 9 00
216	Kern, Philip, Restaurant, 5th bet Jeff & St Clair,	6 00 to 12 00
230	Kiefer, W H, Residence, 218 w Fourth st	7 00 to 10 00
415	Knecht, B F, Restaurant, Third st nr R R Cross'g,	5 00 to 12 00
308	Lowe, T O, Office, cor Third & Jeff up stairs,	9 00 to 12 00 2 00 to 5 00
301	Legler, Barlow, & Co, Dry Goods, etc, Main st	7 30 to 6 00

Call Number.	Names. Location.	Business hours. A. M. P. M.
422	Lowe Bros, Paints & Oils, 3d st bet Jeff & St Clr,	7 00 to 6 00
517	Lane, E J, Residence, Dayton View	12 30 to 1 30 6 00 to 12 00
133	Lowes, Dr, Office and Res, Fifth st nr Ludlow. .	7 00 to 9 00 1 00 to 3 00
319	Mott, F B, Office, Huston Building, Third st . .	7 00 to 6 00
512	Mott, F B, Residence, June st	All hours.
518	Murray, Chas, Restaurant, 92 s Jefferson . . .	5 00 to 12 00
111	Malleable Iron Co, Miami City, W Dayton . .	7 00 to 6 00
416	Marshall, Graves & Co, cor Marshall and Pine .	7 00 to 6 00
522	Miller, Frank, with Bradstreet and Son . . .	7 00 to 9 00
204	Mead, H E & Co, Paper Ware House, Second st,	7 00 to 6 00
222	Marshall, A C, Residence, s Jefferson st	7 00 to 10 00
105	Murphy, J A, Coal Yard, cor First and Webster,	6 30 to 6 30
513	Murphy, J A, Branch Office, Jefferson st	7 00 to 8 00
106	Mead & Nixon, Office, Main st, Music Hall . .	7 00 to 6 00
516	Mead & Nixon, Paper Mill, Front st	7 00 to 6 00
521	Merchants National Bank, s w c Third & Jeff .	8 00 to 4 00
232	Messler, P P, Livery Stable, w Third st . . .	All hours.
126	Miller, C H, Photographer, s Main bet 3d & 4th,	7 00 to 10 00
543	Munger, Warren, I O O F Temple	
411	Mull & Underwood, Confectionery, e Fifth st .	6 00 to 11 00
125	McGowen, Peter, Livery Stable, s Main st . . .	All hours.
307	McKee, Weakly & Co, Grocers, n Main st . . .	6 30 to 6 00
100	McIntire, J K & Co, Grocers, e Third st	6 00 to 6 00
323	McGowen & LaRue, Livery Stable, e Fourth st,	All hours.
201	Newcomer, J, Grocer, 32 n Main st	6 00 to 9 00
226	Naureth, J V & Son, Grocer, s Main st	7 00 to 8 00
341	Nixon, A H, Sheriff's Residence, w Third st . .	7 00 to 8 00
535	Neal, Dr T L, office, Wilkinson st	12 30 to 2 00 6 00 to 9 00
108	Ohio Insurance Co, e Third st	8 00 to 6 00
113	P C & St L R R, Third and Bainbridge	All hours.
331	Phillips House, cor Third and Main	All hours.
412	Pierce, J H & Co, Sash Factory, c Wayne & State	6 00 to 7 00
316	Peck & Ritchie, Patent Lawyers, office, e 3d st	8 00 to 12 00 1 30 to 5 30
419	Pretzinger, R & Bro, Druggists, Third st under Beckel House	7 00 to 9 00
425	Pretzinger, R, Residence, cor Main and Union .	All hours. 7 00 to 10 00
129	Pryor, E F, Residence, 205 s Ludlow	All hours,
426	Patterson, S J, Coal Yard, cor 5th & Wilkinson	6 00 to 7 00
130	Patterson, S J, Branch Office, 4 n Main	6 00 to 7 00
120	Parmely, M B, Dry Goods, e Third st	7 00 to 6 00
336	Powell, Chas E & Co, Second st.	7 00 to 6 00
538	Police Office, City Building	7 00 to 6 00
338	Platt, J D, Residence, 428 w Second	All hours.

Call Number.	Names. Location.	Business hours. A. M. P. M.
439	Peters & Burns, 134 s Jefferson	8 00 to 12 00 1 00 to 9 00
138	Powell Bros & Co, 14 n Main st	6 00 to 9 00
309	Reed, J Lane & Co, Plow Works, Front st . .	7 00 to 12 00 1 00 to 6 00
115	Renold, J, Restaurant, cor Fifth and St Clair .	7 00 to 11 00
203	Raugh, E & Son, Warehouse on Canal	7 00 to 6 00
509	Raugh, E & Son, office, 312 e Third st	7 00 to 10 00
321	Ritty, Jas, 10 s Main st	All hours.
101	Receiver's Office, D & S E R R, cor 1st and Main	7 30 to 8 00
414	Rogers, R A, Paper Warehouse, 119 e Tbird st .	7 00 to 6 00
102	Reed, J Lane, Residence, Jefferson st	
218	Rouzer, John, Factory, Wyandott st	7 00 to 6 00
303	Rogers, Engle & Co, Hardware, n Main st . . .	7 00 to 8 00
207	Reynolds & Reynolds, Printers, cor 2d & Jeff'sn	7 00 to 6 00
531	Rickey, Dr, A C, e Fifth st	All hours.
137	Rohr, G F, Hardware, 19 e Third st	7 00 to 8 00
238	Rickey, Jas, n Main st	7 00 to 8 00
537	Reigel, F M & Co, cor Pine and Marshall . . .	7 00 to 12 00 1 00 to 6 00
417	Starr, C A, Coal Yard, s Wayne st	7 00 to 9 00
500	Sanders, Gus, e Third st	7 00 to 12 00
121	Sharpe's Trade Palace, e Third st.	7 00 to 6 00
325	Schneider, C E, Gun Store. s Main st	7 00 to 9 00
526	Stevens, A, Restaurant, Ludlow st	6 00 to 12 00
421	Sanders, W, Wine House, e Third st	7 00 to 9 00
515	Stoddard, J W and Co, cor Bainbridge and State st	7 00 to 6 00
402	Smith Vaile and Co, Keowee st	7 00 to 12 00 1 00 to 6 00
300	Second National Bank, cor Third and Jefferson. .	8 30 to 5 30
224	Schwartz, S C, s Main st	7 00 to 9 00
434	Schwartz, S C, Residence, Room 80 Beckel House,	7 00 to 9 00
332	St John Machine Office, w Third st, C Baird Agt,	7 00 to 10 00
234	Scheibenzuber, Dr, Office, e First st	8 00 to 9 00 2 00 to 3 00
536	Stoddard, Fowler, Residence, e First st	7 00 to 10 00
314	Thresher & Co, Office, e Third st	7 00 to 5 30
210	Thresher & Co, Varnish Factory, e Car Works . .	7 00 to 5 30
217	Thomson, H C, Grocer, 34 e Third st.	6 30 to 8 30
225	Tizzard, Dr, s Jefferson st.	All hours.
541	Tower Varnish Co. Factory, e Hydraulic	
514	U S Exp Co, e Third st	7 00 to 6 00
228	Union Pass Depot, w Sixth st	All hours.
123	U B Publishing House, cor Main and Fourth . .	7 00 to 6 00
337	Western Union Tel Co, s Jefferson, Public Line .	All hours,
116	Western Union Tel Co, s Jefferson, Private Line .	All hours.
132	Wolf, W & Bro, w Third st	6 00 to 10 30
205	Whitmore Bros, cor Water and Foundry	7 00 to 7 30

Call Number.	Names. Location.	Business hours. A. M. P. M.
400	Wyatt, H & T, 36 e Second st	7 00 to 8 00
420	Wilson, Geo, P O News Depot	7 00 to 10 00
304	Whitesides, Dr, office, Huston building	7 00 to 12 00 1 00 to 6 00 7 00 to 9 00
227	Williamson & Co, e Fifth st	7 00 to 12 00 1 00 to 6 00
408	Weidner, J & P, e Fifth st	7 00 to 12 30
320	Water Works Office, City Building, room 7	8 00 to 12 00 2 00 to 5 00
406	Water Works Pump House, Weowee st	All hours.
529	Webster. Dr W, Office, 127 s Ludlow	7 00 to 9 00
330	Whitten's Central Stores, 24 e Fifth st	6 00 to 9 00
104	Weed & Co, 12 n Jefferson st	7 00 to 6 30
427	Webster, Dr J K, 442 e Fifth st	All hours.
127	West, Billy, cor Fifth and Jefferson	6 00 to 12 00
329	Wollaston, J, e Third near Main	6 30 to 10 30
334	Walters. J B, cor Third and St Clair	7 00 to 9 30
135	Wood, Capt E M, Residence, s Jefferson	All hours.
305	Wolf, J P & Co, First and Foundry	7 00 to 6 00
141	Warman, C, 107 s Jefferson st	
241	Wood, C B & Co, Third and Clinton	7 00 to 12 00 1 00 to 6 00
242	Whitmore, J D, Wayne st and R R Crossing	
442	Walker & Walker, Third bet Jeff and St Clair	
342	Young & Young, I O O F Temple	8 00 to 10 00
407	Zellers, Abia, n Main st	7 00 to 9 00

The following named persons have ordered Instruments, and will be connected with the Central Office very soon:

NAME. LOCATION.	BUSINESS HOURS.
Babbitt T S & Co, West Main st.	
Beaver Leon. Architect, Office Pruden Building.	
Broadrup Huffman & Co, Bayard West Wilkinson.	
Bellows R R, Ticket Office.	
Bunker H P, Fourth and Jefferson.	
Brice S T, Office South Wilkinson st.	7 to 6 p m
Brown Chas H, Residence 133 South Ludlow st.	
Bimm E & Sons, East First st.	
Bimm E & Sons, Ice House East of Car Works.	
Blau M, Mill and Canal st.	
Brownell John & Co, First st.	
Bates W L, Office Journal Building.	
Buvinger G W & E E, East Third and Canal.	
Beaver & Butt, St. Clair bet Third and Fourth.	
Beaver B, Residence 414 Water st.	
Butt John W, Residence Jackson st.	
Canby E, Residence West Water st.	
Conover Sam, Residence Ringgold st.	
Cushman E J, 114 Huffman ave.	
Clark Chas. Residence Warren st.	
City Infirmary, South Brown st.	
Cotterill Sam, Residence South Jefferson st.	
Croy Wm, Residence cor Main amd Lincoln.	

Name. Location.	Business hours
Clegg Joseph, Residence cor Fifth and Jefferson,	All Hours.
Columbia Bridge Works, D H & C C Morrison, Proprietor.	
Cohan John, Grocery and Residence cor Oak and Jay,	All Hours.
Dancyger, Residence St. Mary's st.	
Dornbusch, Livery East Fifth st.	
D & S E Round House.	
D & S E Hoist.	
Dayton Savings Bank, East Fifth st.	
Dayton Insurance Co. cor Third and Jefferson.	
Dayton Hedge Co, Office, Third and Perry, Dayton Hedge Co, Stables, East Third,	8 to 12 m. 1 to 9 pm
Excelsior Oil Works, 326 East Third st.	
Gebhart S & G, West Third st.	
Griffith Bros, East Third st.	
Germann M, 314 West Third st.	
Gebhart Alex, Wayne st and R R.	
Gaddis Thos P, Residence Summit st.	
Huffman Wm, Office East Fifth st.	
Humphrey A, Residence McPherson.	
Holden Geo, Residence First st.	
Hillman C, 418 East Fifth st.	
Hoffman W H, 1023 East Fifth st.	
Hannah Bros, 321 East Fifth st.	
Jacobs Harry, 385 West Third st.	
Klees John, Bottling Works First and Canal.	
Lewis B W & Son, 411 East First st.	
Lowe Col J G, Residence Main st.	
Lane Geo M, Central ave Dayton View,	All Hours.
McSherry D E & Co, Third and Clinton,	7 to 6 p m
McCausland W J, Store Third and Kenton.	
Miller M, Store Dayton View.	
Mayors Office, Sixth and Tecumseh.	
Mead H E, Residence Oakwood.	
Mead C E, Residence 21 East First st.	
Miller August, Store Wayne and Adams,	5 to 11 p m
Moffett M J, Yard Third and Dutoit,	6 to 7 p m
Morrison D H & C C, Pruden Building.	
Mulford Smith & Bradley, Pruden Building,	7 to 9 p.m
Nolan M P, Office Third st Cleggs Block.	
Nixon Thos, Factory First and Canal.	
Nash R Jr, Residence 437 East Water st.	
Owen Pixley & Co, Store Third bet Main and Jefferson.	
Olt M, Store 22 South Market st.	
Parrott Col E, Residence Oakwood.	
Parrott Geo & Chas, Office Upper Hydraulic.	
Parrott Eugene, Residence Oakwood.	
Patterson & Co, Yard Third and Kenton.	
Peters Wm, Yard Clinton st.	
Parmely M B, Residence East First st.	
Palmer A O, Residence 23 Bridge st.	
Pruden David, Residence Mound and Third.	
Rickey James, Residence West Second st.	
Rogers R A, Factory Third and Canal.	
Reizer Powell, Grocery 1123 Wayne st.	
Rowe & Lighthall, Yard cor Third and Montgomery,	6:30 to 7 p m
Stoddard J W, Residence Dayton View.	
Steward & Conklin, Main near Second.	
Sanders A, Jefferson near Market.	
Sachs & Pruden, Druggists Third and St. Clair.	
Spencer Ed, Store 1572 Third and June,	5 to 11 p m
Simons A, Dayton View Hydraulic,	7 to 5:30 p m
Scheibenzuber Dr, Residence South Wayne st.	
Station House, East Sixth st.	
Smith S N & Co, Alley near Parker and Powell Main st,	7 to 6 p m
St John A, Residence Linden ave near Third,	All Hours
Taylor B C, Factory 228 West Fifth st,	7 to 6 p m
Trentman C A, Spice Mills cor Barr and Dutoit.	
Todd W D, Office 12 South Jefferson,	7 to 8 p m
Wolf Bros, Residence St. Mary's,	All Hours
Wilson Geo, Residence West Third st.	
Webster W W, Residence 125 South Ludlow st,	All Hours
Walters A, Undertaker Franklin st.	
Webber S H, Yard Jefferson st.	
Woodsum Machine Co, Keowee and Pitts.	7 to 6 p m
White W B, Stable 83 East Fourth st.	
Wight C & Son, Yard Water and Sears,	6 to 7 p m
Wight C & Son, Yard West Side Third R R crossing,	6 to 7 p m
Wight C, Residence 376 West Second st.	
Young Jas C, Office I O O F Temple,	8 to 12 a m 1 to 6 p m
Zeller Abia, Residence Wilkinson bet Fourth and Fifth.	
Zell J S, Dentist East Fifth st.	
Zoll and Hauser, Market st.	

Name.	Location.	Business hours
Hancock Prof John, Office Supt of Schools, Andrews Jas R, Clerk B'd Education,	City Building	8 to 11 a m 1 to 3 p m

Stivers Capt C B, Principal High School cor Wilkinson and Fourth sts.
Blackwood Miss Jane W, Principal Normal School Huffman ave bet May and Centre.
Loos Chas L, Principal First District School Second bet Madison and Sears.
Morgan A P, Principal Second District School Perry bet First and Second.
Shauck A B, Principal Third District School, Ludlow bet Sixth and Franklin.
Wilson S C, Principal Fourth District School cor Brown and Hess.
Willoughby A J, Principal Fifth District School Fifth st bet Clinton and High.
Loehninger Ferd, Principal Sixth District School Hermann bet Brown and Wayne.
Widner Ester A, Principal Seventh District School cor Fifth and Barnett.
Johnson Jos E, Principal Eighth District School Texas.
Johnson Wm H, Principal Ninth District School Huffman ave bet May and Centre.
Brown John G, Principal Tenth District School Fifth st near Levee.
Schools open from 8:30 to 12 a m, and from 1 to 4 p m on school days.

Classified List Edison Telephone Exchange.

Attorneys and Solicitors.

Brown, O B, 17 e Third st.
Boltin & Shauck, cor Main and Second sts, Eaker building.
Bellville, W J & J J, No. 6 s Main st.
Bellville, W, McKemy, W D, Elliott, Judge H, all of 22 e Third.
Gunckle & Rowe, n Main st, Winter's building.
Humpreys, A, Jefferson st, Odd Fellows Temple.
Iddings & Iddings, 34 n Main st.
Lowe, T O, n e cor Jefferson and Third.
Munger Warren, cor Third and Jeff, Odd Fellows Temple, upstairs.
Nolan, M P, 28 e Third.
Peck & Ritchie, 34 e Third.
Young & Young, cor Third and Jeff, Odd Fellows Temple, upstairs.
Young, Jas C, 30 nr Main st.

Architects.

Beaver, Leon, cor 5th and Main, Pruden's Building.
Peters & Burns, s Jefferson st, Clegg's Building.

Bakeries.

Bauman, A L w Third st.
Heathman, G W, & Co, cor Second and St Clair.
Wyatt, H & T, 136 e Second st,

Banking Houses.

Dayton Savings, 432 e 5th st.
Gebhart, Harman & Co, 3d nr Jefferson.
Merchants National, 3d and Jefferson.
Second National, 3d and Jefferson.

Book Stores.

Rickey, James, 28 n Main st.

Bagging Factories.

Gebhart, Josiah & Co, cor 2d and Front.

Clothiers and Cloth Houses.

Legler, Barlow & Co, dry goods, notions and cloth, Main near 2d.
Barlow Clothing House, 2d st near Main.
Church, J S, Jefferson near post office.
Eversole & Ries, 3d st bet Main and Jefferson.
Owen, Pixley & Co, 3d st bet Main and Jefferson.
Schwartz, S C, Main st near market house.
Huber & Lyons, Main st near market house.

Confectionery, Fruit and News Depots.

Anderton, Chas, e Third st.
Bradstreet & Sons, Commission House, 4th st near Jefferson.
Gray, T H, Third st, near Main.
Kiefaber Bros, Third st near Jefferson.
Mull & Underwood, Fifth st near Jackson.
Wolf Bros, Third st near Main.
Wilson, Geo, P O News Depot, cor 4th and Jefferson.
Freeman, W D, agent Enquirer, Jefferson st, 2d floor, near W U Telegraph Office.
Zoll & Houser, Market st.
Cox, John G, 4th st near Jefferson.
Johnston, Sam, Main st between 3d and 4th.

Contractors and Builders.

Brown, S N & Co, s e cor 4th and St Clair.
Beaver & Butt, St Clair bet 3d and 4th.
Rouzer, John, Wyandott st.
Pierce, J H & Co, cor Wayne and State.

Commission and Brokers Offices.

Bates, W L, Journal Building.
Cox, J C, Huston Building.
Mott, F B, Huston Building.
Todd, W D, 12 s Jefferson.

Coffee and Spice Mills.

Canby, E, 302 to 308 w Water st.
Trentman, C A, cor Barr and Dutoit.

Commercial Collectors and Insurance Agencies.

Dayton Insurance Co, Huston Building.
Dennis, G B & Co, Main bet 2d and 3d.
Firemans Insurance Co, Jefferson st bet 2d and 3d.
Ohio Insurance Co, 3d nr Jefferson.
Worman, C, Jefferson st nr Postoffice.

Churches.

German Reform Church Study, Rev Wm A Hale pastor, n Ludlow.

Dentists.

Hubbard, L & H, Pruden Building, 5th st.
Tizzard, S B, Jefferson nr 5th.
Whiteside, A T, e 5th nr Brown.
Zell, J L, 6 e 5th st.

Druggists.

Abbey, James, 26 s Main st.
Dixon, Geo M, cor Main and 2d.
James, H F, Third st near Main.
Pretzinger, R & Bro, Third st near Jefferson.
Sachs & Pruden, s e cor 3d and St Clair.
Walters, J B, n w cor 3d and St Clair.
Zeller, Abia, n Main st.

Dry Goods Houses.

Dancyger & Son, 106 e 3d st.
Parmely, M B, 114 and 116 e 3d st.
Sharpe's Trade Palace, 14, 16, and 18 e 3d st.

Foundry and Machine Shops.

Barney & Smith Mfg Co, n Keowee st.
Buckeye Iron and Brass Works, Third and Canal.
Malleable Iron Co, r r crossing, Miami City.
Boyer & McMaster, w Bayard st.
Brownell, John & Co, First and Madison.
Smith, Vaile & Co, n Keowee st.
Broadrup, Huffman & Co, Mfrs Office and School Furniture, cor Bayard and Prairie.
Callahan, W P, e Third st.
Columbia Bridge Works, D H & C C Morrison, office cor 5th and Main, Pruden building.

Grocers—Wholesale and Retail.

Bright & Crossley, cor Third and St Clair.
Brinkle, H, e 5th head of McDonough.
Bimm, E & Son, e 1st nr Canal.
Hanitch, H, s Main under Phillips House.
Hoffman, W H, 1023 e 5th st.
Hilgefort, H, 3d bet Jefferson and St Clair.
McKee, Weakley & Co, n Main bet First and Second.
McIntire, J K, e 3d bet Jefferson and St Clair.
Naureth, J V, s Main bet 3d and 4th.
Newcomer, J, 32 n Main st.
Powell Brothers, 14 n Main st.
Reizer, Powell, 1128 s Wayne st.
Spencer, Ed, 1502 e 3d st.
Thomson, H C, 3d bet Main and Jefferson.
Whitten's Central Stores, e 5th bet Main and Jefferson.

Gun Stores.

Dodds, James, 11 s Main st.
Schneider, C E, 35 s Main st.

Galvanized Iron and Cornice Works.

Bretch & Evans, 3d st near Canal.
Buvinger, G W & E E, 3d st near Canal.
Germann, M, 344 w 3d st.

Hides and Scrap Metal.

Raugh, E E Son, Third st near Canal.
Blau, M, on Canal near Third.

Hardware and Iron.

Rogers, Engle & Co, n Main st.
Barnett, R & Co, Wayne st near 5th.
Rohr, Geo F, Third st near Main.
Gebhart, S & G, Third and St. Clair.

Hotels.

Dickey House, cor 6th and Ludlow.
Phillips House, cor 3d and Main.

House Furnishing Goods.

Stewart & Conklin, Main nr 2d.

Jewelers and Opticians.

Best, W H & Co, cor Main and 3d.

Knife and File Makers.

Simmons, A A, Dayton View Hydraulic.
Clark & Co, e 2d st near Canal.

Lumber Yards.

Dickson, W B & Co, 1st and Sears.
Davis, Sam, 5th and McDonough.
Gebhart, Alex, Wayne st Crossing.
Houk, M J, Wayne nr 3d.
Peters, Wm, Clinton nr 3d.
Wight, C & Son, Yard Water st.
Wight, C & Son, Branch w 3d st R R Crossing.

Livery Stables.

Cathcart, Jas, Jefferson st opp Market House.
Dempsey, Jas, 3d nr Wyandott.
Dornbusch, 5th nr Wayne.
McGowen, Peter, Main s of 5th.
Messler, P P, 3d st nr Phillips House.
McGowen & LaRue, 4th bet Main and Jefferson.
White, W B, 4th nr Jefferson.

Laundries.

Bowden, J A & Co, 2d nr St Clair.

Mills and Milling Supplies.

Gebhart, S & Sons, cor 3d and Front.
Gebhart, J R & Son, cor 3d and Canal.
Weed & Co, Jefferson nr 3d.

Telegraph and Express Offices.

W U Telegraph, Jefferson nr 3d.
U S Express } e 3d nr Jefferson.
American }

Manufacturers of Cigars and Dealers in Tobacco.

Cotterill, Fenner & Co, 2d nr Jefferson.
Hannah Bros, 5th nr Brown.
Powell, Chas L & Co, 5 e 2d st.
Wolf, J P & Co, 1st and Foundry.
Warman, C, 107 s Jefferson st.
Wollaston, J & Co, 3d nr Main.

Music Stores.

Italian Band, 5th nr Commercial.
Kenney, J T, Main nr 4th.
Williamson & Co, 5th nr Main.

Meat Stores.

Jacobs, Harry, 385 w 3d st.
Jacobs, N & C & Co, Market st.
Miller, August, 918 s Wayne st.
Olt, M, 22 Market st.

Manuf'rs and Dealers in Varnishes, Paints and Oils.

Clegg, Wood & Co, Wyandott and 4th.
Thresher & Co, Third st near St Clair.
Tower Varnish Co, 1250 e 1st, Chas Tower, pres.
Lowe Bros, Third st near St Clair.
Excelsior Oil Works, 326 e Third st.

Manufacturers of and Dealers in Paper Goods.

Aulabaugh, Crume & Co, cor 4th and St Clair.
Holden Manufacturing Co, e 2d st near Main.
Mead & Nixon, n Main st, Music Hall building.
Mead, H E & Co, 19 e Second st.
Nixon, Thos, 216 n Main st.
Rogers, R A, & Co, 119 e Third st.

Manufacturers of Agricultural Implements.

Reed, J Lane & Co, n Front st near Third.
Stoddard, J W & Co, cor Bainbridge and Third.
McSherry, D E & Co, e Third st.
Marshall, Graves & Co, cor Marshall and Pine.
Woodsum Machine Co, cor Keowee and Pitts.
Farmers Friend Mfg Co, cor State and Wayne.
Dayton Plow Works, cor First and Front.
Aughe Plow Works, Geo & Chas Parrott, Upper Hydraulic.
Taylor, B C, w 5th st.

Manuf'rs of Soda Water & Vinegar.

Klees, John, cor 2d and Canal.

Offices for Coal and Wood Yards.

Conover & Hayden, Yard State st nr Blind.
Davis, I, Yard 5th st R R Crossing.
Davis, I, Branch cor Maple and Perry.
Jackson Coal Office, 3d st opp McDonough.
Murphy, J A, Yard 1st and Webster.
Moffet, M J, 3d and Dutoit.
Murphy, J A, Branch Office Jefferson st nr Beckel.
Patterson, S J, Yard 5th and Wilkinson.
Patterson, S J, Branch Main st nr 3d.
Patterson & Co, Yard 3d and Kenton.
Rowe & Lighthall, cor 3d and Main st.
Starr, C A, Yard Wayne st.
Wood, C B & Co, 3d and Clinton.
Whitmore Bros, Water and Foundry.
Whitmore, J D, Wayne st R R Crossing.

Millinery and Notions.

Babbitt, T S & Co, wholesale, n Main st.
Griffith Bros, wholesale, e 3d st.
Smith, Mulford & Co, wholesale, Pruden building, 5th st.
Hillman, C, retail, Temple of Fancy, 448 e 5th st.

Public Offices and Schools.

County Clerk, Court House.
City Clerk, City Buildings.
City Hospital, Franklin nr Ludlow.
City Infirmary, Brown st opp Union.
Mayor's Court, 6th st nr Tecumseh.
Police Office, City Building.
Water Works Office, City Buildings.
Water Works Pumping House, Keowee st and Mad River.
Station House, 6th st nr Tecumseh.
Wood Measurer, Public Landing, Canal Basin bet 2d and 3d.
Dayton Law Library, 3d st adjoining Superior Court.
Superintendent Schools / Clerk Board of Education } City Buildings, Main st.
High School, cor Wilkinson and 4th.
Normal School, Huffman ave bet May and Centre.
First District School, 2d st bet Madison and Sears.
Second District School, Perry st bet 1st and 2d.
Third District School, Ludlow st bet 6th and Franklin.
Fourth District School, cor Brown and Hess.
Fifth District School, 5th st bet High and Clinton.
Sixth District School, Herman st nr Brown.
Seventh District School, cor 5th and Barnett.
Eighth District School, Texas n Dayton.
Ninth District School, Huffman ave nr Main.
Tenth District School, 5th st nr Levee.

Physicians and Surgeons.

Ackelson, Dr, cor 5th and Ludlow.
Jennings, Dr, Wilkinson st between 2d and 3d.
Jewett, Dr, Jefferson st bet 2d and 3d.
Lowes, Dr, 5th st near Ludlow.
Neal, Dr, Wilkinson st near 2d.
Rickey, Dr, con 5th and Brown.
Schiebenzuber, Dr, 1st st near Main.
Webster, Dr W W, 127 s Ludlow st,
Webster, Dr J K, 442 e 5th st.
Daugherty, Dr, cor 5th and Ludlow.

Photograph Galleries.

Bunker, P, cor 4th and Jefferson.
Miller, C H, Main bet 4th and 5th.

Provision and Feed Stores.

Miller, Mike, Dayton View.
McCausland, W J, 3d and Canal.

Plumbers.

Gibbons & McCormick, Jefferson st near 3d.

Printing Establishments.

Croy, McFarland & Co, cor 6th and Main.
Journal Office. n Main st.
Reynolds & Reynolds, cor 2d and Jefferson.
U B Book Store, cor Main and 4th.
Walker & Walker, Third st near St Clair.

Queensware.

Fox, C E, 3d st near Main.

Residences.

Bright, G B, s Jefferson, near Fifth st.
Brown, S N, s Wayne.
Brown, Chas H, 133 s Ludlow.
Beaver, B W, 414 Water st.
Butt, John W, Jackson st.
Canby, E, w Water st.
Conover, S, Ringgold st.
Cushman, E J, 114 Huffman avenue.
Crossley, Capt, w Second st.
Clark, Chas, Warren st.
Cotterill, Sam, s Jefferson st.
Croy, Wm, cor Main and Lincoln sts.
Cohan, John, cor Oak and Jay.
Dancyger, St. Marys st.
Echwright, Capt F, 131 Commercial st.
Freeman, W D, s Wayne st.
Gebhart, Geo, s Wayne st.
Gimperling, J E, cor 2nd and Webster.
Gaddis, Thos P, Summit st Miami City.
Humphreys, A, McPherson.
Hughes, R D, 22 Bridge st.
Harman, Ezra, s Wayne st
Hollingsworth, D L, 138 w Third st.
Holden, Geo, First st.
Kiefer, W A, 218 w Fourth st.
Lane, E J, Dayton View.
Lowe, Col J G, s Main st.
Lane, Geo M, Central avenue, Dayton View.
Mott, F B, June st.
Mead, H E, Oakwood.
Marshall, A C, s Jefferson st.
Mead, C E, e First st.
Nash, R Jr, 437 e Water.
Nixon, A C, sheriff, county jail w Third st.
Pryor, E F, 205 s Ludlow st.
Pretzinger, R, s Main st.
Parmley, M B, e First st.
Platt, J D, 428 w Second st.
Palmer, A O, 23 Bridge st.
Pruden, David, Mound st, Miami City.

Residences.

Parrott, Eugene, Oakwood.
Parrott, Col E, Oakwood.
Reed, J Lane, Jefferson st.
Rickey, Jas W, w 2d st.
Stoddard, J W, Dayton View.
Stoddard, Fowler, e First st.
Schiebenzuber, s Wayne st.
Swartz, S C, room 80, Beckel House.
St. John, A, Linden anenue, near Third st.
Wilson, Geo W, 305 Warren st.
Wight, C, 376 w Second st.
Wood, Capt E M, s Jefferson st bet 4th and 5th.
Wolf Bros, St Mary's st.
Webster, Dr W W, 125 s Ludlow st.

Real Estate and Ticket Agencies.

Bellows, 3d st, Huston Building.
Fellows & Bragg, w 3d nr Phillips House.

Railroad Offices and Depot.

A & G W, J Hardy, agent, freight office, 1st and Keowe st.
Alexander, G M D, agent S Shore Line, n Main st.
C C C & I, B F Hargrave, agent, cor Carnell and Water.
D & M and C H & D, Lewis Cassell, agent, freight depot n e cor 3d and Webster.
D & U, Chas E Miller, agent, freight office cor Prairie and 6th.
D C & T R R Offices, cor 5th and Main, Pruden building.
D & S E, E F Pryor, agent, cor 3d and McDonough.
D & S E Round House, n s 1st st e of Keowee.
D & S E Hoist, n s 1st st e of Keowee.
G W Despatch, C Chamberlain, agent, 13 s Main st.
P C & St L, J H Zell, agent, cor 3d and Bainbridge.
Receiver's Office D & S E, J E Gimperling, Receiver.
Union Passenger Depot, Chas H Clough, ticket agent.

Sewing Machine Offices.

St John, Chas Baird, agent, w Third st, near Main.

Saw Manufacturers.

Lewis, B W & Son, 411 and 413 e 1st st.

Stone Yards.

Brice, S T, Wilkinson st and Union Depot.
Huffman, Wm, e 5th and Huffman ave.
Webber, L H, Jefferson st opp Buckeye.

Wholesale and Retail Liquor Dealers.

Beckel & Pohlmeyer, 5th and Brown.
Fritch, Nippen & Co, 3d nr St Clair.
Fletcher, J R, cor 5th and Brown.
Kern, Philip, 5th opp Stone st.

Wholesale and Retail Liquor Dealers.

Knecht, B F, e 3d st Railroad crossing.
Murray, Chas, Jefferson nr 4th st.
Renolds, J, 5th and St Clair.
Ritty, Jas, Main nr 3d.
Sanders, W, 3d bet Jefferson and St Clair.
Sanders, Gus, 3d bet Jefferson and St Clair.
Sanders, A, Jefferson nr Market.
Stevens, A, Ludlow and Baker.
Weidner, J & P, 5th opp Montgomery.
West, Wm, cor 5th and Jefferson.

NOTICE.

Subscribers must not, *under any circumstances*, disturb the battery or connections, or *attempt to adjust their Instrument in any particular*. This work is assigned to experts, who will wait on you as soon as possible after receiving intelligence that your Instrument needs adjusting, and you will do us a very great favor by reporting promptly over some other line any continued trouble.

We have a large force of operators, who are recommended for intelligence, activity, patience and gentlemanly deportment. The frequent occurrence of an avalanche of signals prevents immediate answer, or may for the moment ruffle the temper of an operator and cause an apparent ill-natured remark to an impatient caller. Parties must make due allowance for this, and report evident inattention, ungentlemanly conduct, or improper language indulged in over the lines, which will command immediate attention.

We are at all times disposed to allow the privilege of conversation with the Exchange to satisfy mere curiosity, but request it will be done in moderation during business hours.

Our long list of subscribers, including the Courts, Public Offices, Law Library, Infirmaries and School Houses, with the established fact that the bulk of important business is done over our wires, attests the value of the **Edison Telephone**, and establishes it as the favorite.

The hours for business furnished by most subscribers at our request, will answer many inquiries, and prevent many calls that can not be answered.

Our arrangements at the Water Works Pumping House give us every advantage for fire alarms, without the confusion and damaging effect produced by connection with each hose house over the fire alarm poles and wires.

Subscribers are at liberty to send in calls over any line within their reach, when away from their own, by consent of subscriber to whom they apply. Business men will understand the mutual advantages of this plan, and need not be imposed upon.

We have made a permanent arrangement with the celebrated Italian Band or Quintette Club of Harpists and Violinists, connecting their practice room to the Exchange, for the entertainment of our subscribers during evenings when the band is not otherwise engaged.

Exchange or Central Office open day and night.

Instruments will be supplied as fast as we can obtain them by express from the manufacturers.

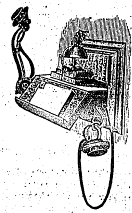
Revised lists will be issued on the first of each month.

G. W. HOGLEN, Manager.

READ THIS PAMPHLET

CAREFULLY!

AND BE



Governed by its Instructions!

WHEN NOT IN USE KEEP IN SIGHT NEAR THE INSTRUMENT.

Gold and Stock Telegraph Company

This folder contains printed material issued by the Gold and Stock Telegraph Company. Organized in 1867, this company furnished gold and stock price quotations by telegraph.

The following item has been filmed: "Edison's 'Universal Printer' for Private Lines. Instructions" (ca. 1871-1873).

THOS. A. EDISON,
ORANGE, N. J.

EDISON'S

"UNIVERSAL PRINTER,"

FOR PRIVATE LINES.

INSTRUCTIONS.

GOLD AND STOCK TELEGRAPH COMPANY,

No. 3.

FOR EMPLOYEES OF THE COMPANY ONLY.


GOLD & STOCK
TELEGRAPH
COMPANY
UNIVERSAL PRINTER

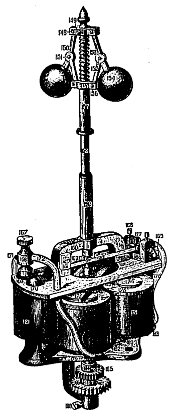

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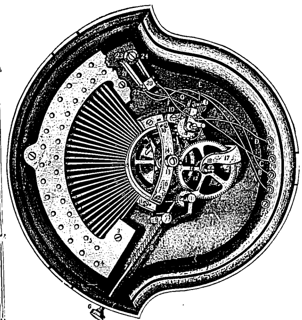
Fig. No. 1.



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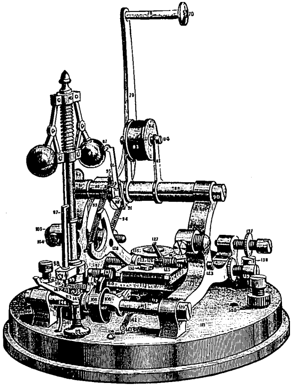

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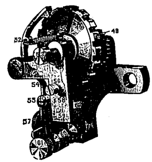

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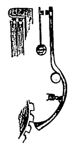

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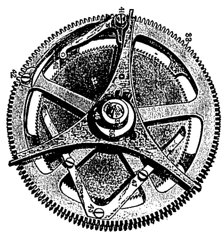

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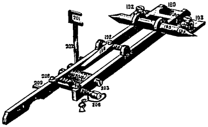


Fig. No. 7.

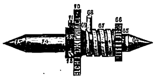


Fig. No. 8.

EDISON'S

"UNIVERSAL PRINTER,"

FOR PRIVATE LINES.

INSTRUCTIONS.

GOLD AND STOCK TELEGRAPH

COMPANY,

No. 3.

FOR EMPLOYEES OF THE COMPANY ONLY.

Universal Printer.

This instrument works upon one line wire. It performs three operations, to wit:

The rotation of the type wheel, the correction of the type wheel and the impression of the letter.

The instrument has two distinct mechanisms—the transmitting and printing devices.

Electric Engine.

The transmitting devices, consisting of the main break, stop pins, etc., are driven by a small electric engine, run by a local battery.

The transmitting devices are detached from the engine while in motion by the depression of any key of the keyboard.

The engine is provided with a governor, by which the speed of the instrument can be increased or decreased, and every instrument in a circuit made to run exactly alike.

The Instrument.

The instrument proper is similar to the stock reporting machine, with the exception of a vibrating contact point, operated by the escapement lever, which opens and closes the local printing circuit. The printing lever is operated by a magnet placed in this local circuit, instead of being placed in a second main circuit, as is done in the stock reporting instrument. The vibrating point is so arranged that the local printing circuit is closed when the main circuit is open.

Magnets.

One magnet, with an armature and forked lever acting on a toothed wheel, gives motion to the type wheel step by step. This magnet is placed in the main circuit, and is called the type wheel magnet.

Another magnet is placed in a local circuit, which circuit is opened and closed by a vibrating contact spring on the escapement lever. Owing to the rapidity of vibration, the local circuit is not closed long enough to allow the magnet to charge and

move the printing lever; but if a key is depressed the vibrating point stops and closes the local circuit, which allows the printing magnet to become charged, and the printing lever is thrown up to the face of the type wheel. The printing magnet is operated by a separate local battery.

The two magnets which operate the electric engine are called the engine magnets.

Description of the Engine.

Fig. 1 shows the engine and its connections. The break spring, 163, is made to vibrate between two contact screws in 164, by a small cam upon the engine shaft, 158. One contact screw is connected to one pair of magnets, and the other contact screw to the other pair.

The other ends of both magnets are connected to one pole of the local battery, and the spring, 163, to the other end. 173 is the revolving armature secured to the engine shaft, 158, by a collar and set screw. This revolving armature and contact spring are so adjusted that the circuit is thrown from one pair of magnets to the other. When the revolving armature is nearly over the

cores of the magnets, by throwing the circuit alternately through the two pair of magnets a constant rotation of the engine shaft is obtained. The screw, 188, holds the cup shaped centre, in which the point of the engine shaft runs.

This centre is made to hold a small amount of oil. 186 is the starting ratchet, which it is sometimes necessary to use to give an initial start to the engine when the battery is switched on, the revolving armature having a magnetic centre. The arm 7 (see fig. 2), extending out through the base, is pushed in to give this motion. 185 is the engine gear wheel, secured to the engine shaft by the screw and collar, 184. This gear wheel (see fig. 2) is connected to the transmitter gear wheels.

No. 157 is a sleeve with a small rim at its lower extremity. It is secured to the cross piece, 155, and governor arms and balls, the whole rising as the speed of the engine shaft increases or decreases.

The bent wire, 97 (see fig. 3), is the device for regulating the speed. This arm is secured to and insulated from 99 by the rubber bushing, 98. To the lower end of this regulating rod is secured the

insulated wire, 141. This rod may be raised or lowered by the screw 101. The extreme end of the rod is bent over towards the sleeve and flange, and, as the governor balls spread out, the flange upon the sleeve comes in contact with the bent portion of the regulating rod; when this occurs the engine battery is "cut off" from the magnets or "short circuited." When this contact takes place the speed decreases, the governor balls drop, and the short circuit is broken and then quickly made again. It is obvious that the position of the rod, 97, will determine the speed of the engine. By referring to fig. 1 it will be seen that the contact spring, 163, is not insulated from, but in connection with the whole frame of the engine. One end of the battery is connected to the frame, and the arm, 97, to the other end of the battery, hence a connection between the end of the rod, 97, and the flange on the sleeve, 157, forms the short circuit.

The contact points in the rubber piece, 164 (fig. 1), should be cleaned every two or three months; but bad contact will not prevent the engine from running, as a failure to make connection in one part of the revolution will be compensated for by

the momentum of the governor balls, which will carry the shaft around to the next contact.

The contact spring, 163, sometimes breaks at the point where it is connected to the brass plate, 161. In this case replace by a new one.

The wire, 141 (see fig. 3), is secured to the regulating rod, 97, by a small screw at its lower end; it sometimes happens that the arm or rod, 97, gets turned in such a position that this small screw touches one of the collars on the shaft, 105, "short circuiting" the engine battery permanently. Care should be taken that the screw is adjusted as far away from these collars as possible, and that the screw, 101, which holds the rod, 97, should be tight, or the outward motion of the governor balls may have sufficient force to loosen the arm, 97. The holding piece, 99, may be turned in any position by a screw at the back.

The Main Break.

Fig. 4 shows the main break; 49 is the main break wheel, having thirty teeth.

Upon the same shaft with the break wheel is a small gear wheel, 48, which is used to connect the

main break with the centre wheel of the instrument; 54 is the main break lever. (See fig. 5.)

A vibratory motion is given this lever by the teeth on the main break wheel.

Upon the extreme end of this lever are two platina points; in front of these points are two flat watch springs secured to a stud, 55; on the extreme ends of these springs are two platina points facing those on the lever, 54. One spring is set slightly in advance of the other (about the thickness of a piece of paper). The two springs are insulated from the arm, 54, and are connected by a wire to one side of the type wheel magnet through a hole in the base, the other end of the type wheel magnet being connected to the line by the wire, A, and binding post, 26.

The arm, 54, and all other portions of the main break are connected by the wire, D, to the binding post, 29, and thence to the main battery and ground.

It will be seen that the main line circuit, within which are the type wheel magnets, is opened and closed by the double platina points. The reason for placing one of the platina points a little in advance of the other is that when the cir-

cuit is broken the spark almost always comes on the point which is set in advance. This keeps one point clean and unoxidized. The point which takes the spark fails to connect about once in every thirty revolutions of the type wheel, but the other point ensures the connection and prevents the type wheel from throwing behind one letter. As this point does not receive many sparks, it will be several weeks before it will be necessary to clean the two points. In cleaning them use fine emery paper, and be careful not to alter their adjustment, as a very slight change will increase or decrease the length of the main break, and interfere with the adjustment of the type wheel.

In receiving a message, the main circuit is prevented from opening at the double platina points by two extension wires, F and G, running to the switch spring holder, 20, and shaft, 23. The two switch springs, 21, are included within the engine circuit, so that, by turning the shaft, 23, the engine circuit can be opened and closed.

There are two brass pieces, 23, inserted in a hard rubber collar on the switch shaft. When the switch is turned, to transmit a message, the

springs, 21, connect across the brass piece and close the engine circuit, which, in its turn, starts the main break, and the type wheels are rotated. At the same time the "cut-off" on the main break is rendered inoperative by the springs sliding off of the brass piece, 23, on to the hard rubber. These brass pieces and contact springs should be kept clean, to obtain perfect connection, otherwise trouble will occur either by the engine circuit or main circuit opening.

Fig. 6 shows the centre gear wheel. Upon the shaft, 38, are two gear wheels, 33 and 34, and a ratchet wheel, 32.

The gear wheel, 34, and ratchet wheel, 32, are secured firmly to the shaft, 38. The wheel 34 is geared into (see fig. 2) the wheel 16, and thence to the engine shaft. The wheel 33 is loose upon the shaft, 38. 31 is the stop lever, also loose upon the shaft, but secured to the wheel 33 by the pin 43. The hole in the stop lever is a little larger than the pin, 43, which allows the lever to have a lateral motion sufficient to lift the click, 39, out of the teeth of the ratchet wheel, 32. The spring, 42, keeps the click up to the ratchet teeth. The three prongs of the stop

lever rotate in the path of the finger key arms. The main break (see fig. 4) is geared into the loose wheel, 33.

The manner of detaching the main break from the engine mechanism while in motion is very simple. If a key is depressed, one of the ends of the stop piece, 31, comes in contact with the key arm and arrests its forward motion. The click, 39, is lifted out of the ratchet wheel, and the gear wheel, 33, and main break (see fig. 2) are stopped, while the engine and its gear wheels continue in motion.

The stoppage of the main break, of course, prevents any further interruption of the main current; the type wheel is stopped; the vibrating point upon the escapement lever closes the printing circuit, and the letter is impressed upon the paper.

If the finger key is raised, the click, 39, falls into the ratchet wheel, 32, the wheel 33 and main break are locked to the engine mechanism, and are carried around until another finger key is depressed.

The spring, 35 (fig. 6), is used for the purpose of providing a slight friction between the mechan-

ism which is stopped and that which is rotated, to prevent a rebound of the former when it is suddenly arrested, and also to ensure the raising of the click, 39, promptly.

In carrying the instrument care should be taken that none of the mechanism underneath the base is displaced by the arm or hand.

All the bearings of the engine mechanism should be oiled occasionally.

The Type Wheel and Printing Mechanism.

Figs. 3, 7 and 8 show the type wheel and printing mechanism. Fig. 3 shows the instrument with the type wheel and printing lever taken out; fig. 7 shows the printing lever, and fig. 8 the type wheel. 86 (see fig. 3) is the unison arm; a pin, 87, on the end of this arm runs into the worm or screw, 67 (see fig. 8). 93 is a spiral spring, which holds the unison arm down to the worm. 201 (see fig. 7) is the unison tripper, the arm, 86, passing through the slot, 201, so that by the raising of the printing lever the unison arm is thrown out of the worm and placed back to the ratchet

wheel, 66. Upon the worm near the type wheel is a stop pin, 68, which, coming in contact with the square end of the unison arm, 86, blocks the further progress of the type wheel. The shaft which carries the type wheel must make three revolutions before the worm will bring the unison arm up to the stop pin, 68. When the type wheel is blocked the escapement lever continues to vibrate until a finger key is depressed. If the first dot key on the extreme left is depressed after the type wheel is blocked, the vibrations of the escapement lever will cease, the printing circuit will be closed, and the printing lever will throw the unison arm away from the stop pin back to the ratchet wheel, and the type wheel is in unison with the dot key, and free to move forward when it is raised.

Before a message is transmitted the engine should be started, and the type wheel allowed to rotate until stopped by the unison arm; then the first dot key should be depressed and held down until the printing lever is thrown up; then the type wheels will be released, and will correspond with your transmitter, and the message can be sent. In the act of sending a message the

finger should not be raised from one key until the next is depressed, otherwise the type wheels might run to unison before the desired letter could be found, and thus put both type wheels out of unison with your transmitter. The keys should not be raised until the printing lever is heard to strike the type wheel.

It sometimes occurs that the type wheel of one instrument will catch at unison on the second revolution, and the other instrument on the third revolution; therefore, when your type wheel is stopped by the unison, you should allow it to be locked for two or three seconds, to ensure the locking of the distant type wheel before depressing the unison dot key.

In receiving the message, if it is found that, after two or three words have been printed correctly, the type wheel throws out and commences to print a jumble of letters, you can break the transmitting operator by turning your switch and starting the engine for an instant. The transmitting operator will notice the irregular breaks and stop; this will allow you to tell him where to go ahead; but it is better for the transmitting operator to go back several words and re-write

when he hears the receiver break. This will prevent the necessity of telling him where to go ahead and save time.

By referring to figure 7 it will be noticed that there are two screws, 192, having jam nuts upon the armature of the printing lever, and are so adjusted that when the armature is attracted the points of the screws hit upon the heads of the magnet cores. The object of these limiting screws is to prevent the printing lever pressing too hard against the type wheel. In fact, the dead motion or shake in the centre screws, which hold the printing lever, is sufficient to allow the upward movement of the printing lever to print the letter and fall back a slight distance from the type wheel; so this prevents the type wheel from being retarded by the printing lever, when it is suddenly started by the raising of a finger key. Were there no screws in the armature of the printing lever, it would lag against the type wheel, throwing it out of unison. The employment of the screws slightly affects the clearness of the letters; but this is more than compensated for by increased reliability of transmission and reception of the message. The shaft, 195, should have some side shake.

The escapement lever shaft, running on the screws, 139, should work freely, but have no *side shake*, otherwise it will surely throw out the type wheel at intervals.

The two prongs of the escapement lever strike the teeth of the ratchet wheel upon their extreme edge; any shake in the escapement lever shaft will allow the lever to fall away from the ratchet wheel, and hit upon the edges of the teeth.

The jam nut of 139 should be kept very tight.

Safety Click.

113 (fig. 3) is called the safety click, its object being to prevent the displacement of the type wheel shaft at the point where the two prongs of the escapement lever are not touching the ratchet teeth.

The point of this click should be oiled, as well as the ratchet wheel.

Inspectors should notice the tensions of the springs and adjustment of the different devices of the instrument when received from the shop, and endeavor to keep them as near to that point as possible when placed upon the line, otherwise an

improper tension of some small spring may prevent the instrument from working satisfactorily.

Diagrams.

Fig. 9 shows the connections for one pair of instruments.

The engine and printing local have three cups of battery each, the two zinc ends of which are connected to the return binding post of the instrument.

The main battery can be divided, half being placed at each end of the line, or all may be placed at one end or in the middle.

X is a switch, which is sometimes included in the main circuit, to open it at night and prevent the consumption of battery material.

Fig. 10 shows the connections for three instruments, with the battery at one end, and a switch for opening the main circuit at night.

Testing Instruments.

Before starting a line the battery should be set up and "short circuited" for one or two days, and the instrument thoroughly tested before it is placed upon the line.

The amount of battery required to work the printing lever magnet is three cups; three for the engine; five cups main for each instrument, and five cups for each mile of line wire; providing, of course, that there are no bad connections or defective ground wires. Any extra battery put on the main will give the instrument a greater margin for adjustment.

Spare Instruments.

A set of spare instruments, thoroughly tested, should be kept on hand to relieve defective instruments outside until they can be repaired.

Dust.

The instruments should be kept free from dust and paper fibre by the inspector. This can be best done by using a wide camel hair brush for the fibre and dust, and a small piece of chamois skin to clean the parts.

The inspector should visit each instrument in the morning; start it up and print a few words, and note how the instrument has worked the previous day by referring to the slip; notice the

strength and condition of the battery, and see that the most important screws are tight.

Inking.

In inking the instrument do not put too much on at once; raise the ink roller off the type wheel, hold it in that position and apply the ink with a small camel hair brush equally over the whole of the cloth. After the instruments have worked several weeks the sharp edge of the letters will have worn a considerable amount of fibre from the cloth of the ink roller, which gathers in and fills up the spaces between the letters. This can be removed by holding a piece of stiff paper up to the side of the type wheel and brushing the fibre upon paper by a small tooth brush; or the type wheel and shaft may be taken out by unscrewing the clamping screws, 104 and 103, and the type wheel soaked in benzine or turpentine, using a brush, and wiping dry before replacing.

In taking out any shaft, such as the type wheel shaft, printing lever, or escapement lever shaft, be careful and *loosen only one screw*, so that when it is replaced it will return to the same position it occupied before it was taken out.

When an instrument is reported to be working badly the first thing is to ascertain that there is no trouble on the line, or with the battery, as it frequently occurs that line and battery troubles are attributed to the instrument, and the mistake not found out until the instrument has been demoralized by adjusting it in all manner of ways.

The following are some of the faults generally found when the instrument is reported out of order:

PAPER CAUGHT.—*Probable Cause.—First.* Reel sleeve bound, or paper unwound and kinked. *Second.* Paper put in wrong.

To Fix it.—First. Loosen the jam nut. *Second.* Instruct subscribers to put the paper in properly.

PAPER FAILING TO FEED—*Probable Cause.—First.* Bind in reel. *Second.* Teeth on upper feed click dull. *Third.* Spring too weak to hold click down on the paper. *Fourth.* Teeth of lower stage click dull. *Fifth.* Spring on lower stage click too weak.

To Fix It.—First. Loosen the jam nut. *Second.* Sharpen the teeth to a fine point with a small oil stone. *Third.* Pull some of the spring through one of the holes, to increase its tension. To make sure that you have remedied it, hold the lower

stage click away from the paper, and try to pull it (the paper) back and forward several times through the instrument. If the feed click prevents the paper from being pulled back the defect has been removed. *Fourth.* Do precisely the same with the stage click.

ESCAPEMENT AND PRINTING LEVER SPRINGS OUT OF ADJUSTMENT.—*Probable Cause.—First.* Taper adjusting pins shaken loose by the jar of the instrument. *Second.* Thread broke. *Third.* Spring stretched so far as to lose its elasticity.

To Fix It.—First. Readjust the taper pins, and push them in very tightly by the hand, and afterwards give them a sharp rap with the handle of a screw driver. *Second and Third.* New thread and spring.

BAD PRINTING.—*Probable Cause.—First.* Type wheel full of fibre. *Second.* Ink too thin. *Third.* Too much ink on. *Fourth.* Ink roller uneven, and does not ink portions of the type. *Fifth.* Type wheel not set properly to strike the letter square. *Sixth.* Pad too flat. *Seventh.* Limiting screws in the printing lever armature adjusted so as to prevent the printing lever from coming up far enough to give a good impression. *Eighth.* Not enough battery power to effect the impression. *Ninth,* Bad pad.

To Fix It.—First. Clean the type wheel. *Second.* Use thickened ink. *Third.* Clean off a portion of the ink. *Fourth.* Change for an even roller. *Fifth.* Set the type wheel so that it will print the letters full, and not print the edge of the letters on each side of it; leave the screw which secures the type wheel to the shaft very tight, to prevent the type wheel slipping. *Sixth.* New pad. *Seventh.* Adjust the limiting screws as before described, and tighten the jam nuts, or they will shake loose by the constant knocking of the ends of the screws on the cores of the magnet. *Eighth.* See that the printing lever works freely, and fix the battery. *Ninth.* New pad.

It will be seen from the above that there are a great many ways in which bad printing occurs, and it will be found that the inspector needs considerable experience to obtain good printing.

THROWING OUT OF TYPE WHEEL.—*Probable Cause.—First.* The escapement lever and type wheel shafts have too much side shake in their centre or pivot screws. *Second.* Not adjusted properly. *Third.* Main break adjusted to give

too long or short closing of circuit. *Fourth.* Binding of the shafts in their centre screws. *Fifth.* Centre screws loose. *Sixth.* Too much tension on the unison arm spring. *Seventh.* Unison arm does not go back far enough. *Eighth.* Magnets adjusted too close to armature of escapement lever (less than $\frac{1}{64}$ of an inch). *Ninth.* Too much or not enough tension on the safety click. *Tenth.* Ink roller touches unison stop pin at each revolution. *Eleventh.* Not enough battery. *Twelfth.* Edge of the escapement lever prong touches too near the edge of the ratchet teeth in vibrating. *Thirteenth.* Bad contacts. *Fourteenth.* Vibrating contact spring adjusted so that the printing circuit is not opened before the type wheel starts.

To Fix It.—First. Take all the shake out of the escapement lever shaft that is possible, but leave considerable shake in the type wheel shaft. *Second.* Adjust properly, which can only be learned by experience. *Third.* Adjust the main break so that the pulsations will sound like short Morse dashes. *Fourth.* Loosen slightly and set the jam nut tightly, and oil. *Fifth.* Tighten. *Sixth.* Decrease the tension so that there will be

only enough to pull the unison arm back, and put a little oil in the slot, 201, of the unison tripper. *Seventh.* Not enough tension on the unison spring, or unison arm bound in screw, or not lifted high enough out of worm; unison tripper bent. *Eighth.* Adjust type wheel magnets about two thicknesses of paper away from the armature when the circuit is closed. *Ninth.* Increase or decrease the tension, by taking up or letting out the spiral spring; the tension on the click should be a little more than the tension of the spring on the unison arm. *Tenth.* Two turns of sounder wire around the ink roller shaft nearest the unison pin, which will prevent the ink roller from approaching near it. *Eleventh.* Experience will determine this. *Twelfth.* Too much shake in the escapement lever or type wheel shafts. *Thirteenth.* Clean the platina points of the main break with fine emery paper, and be sure the trouble is not on the line or a bad connection in the instrument or office.

UNISON ARM NOT CATCHING.—*Probable Cause.—First.* Stop pin too smooth.

To Fix It.—First. Roughen the end.

ENGINE FAILS TO START WHEN THE SWITCH IS TURNED AND THE STARTER PUSHED IN.—*Prob-*

able Cause.—First. Bad connection in the battery. *Second.* Switch springs, 21, fail to connect. *Third.* Vibrating spring, 163, broken. *Fourth.* Engine shaft out of its centre. *Fifth.* Battery cut off or "short circuited" in regulating rod.

To Fix It.—First. Examine battery. *Second.* Clean switch springs and brass piece, 23. *Third.* Replace by a new one. *Fourth.* Replace the shaft in its centre. The engine shaft rests upon a shallow cupped centre, which contains oil, and it sometimes occurs that when the engine starter is pushed in suddenly the spring will lift the shaft out of its centre. *Fifth.* The screw that secures the insulated wire to the regulating rod, 97, touches one of the collars on the shaft, 105, thereby "short circuiting" the engine battery. It should be adjusted away from the collar.

ENGINE STOPS OR SLOWS DOWN WHEN A KEY IS DEPRESSED. — *Probable Cause.* — *First.* Too much friction on the spring, 35 (see fig. 6), or not enough to throw the click, 39, out, and the end keeps knocking on the edge of the ratchet teeth.

To Fix It.—Increase or decrease the tension of the spring by means of the screw, 47.

ENGINE MECHANISM WORKS HARD.—*Probable*

Cause.—First. Gear wheels set too deep into each other. *Second.* Bind in the centres of the three gear wheels. *Third.* Centres want oil. *Fourth.* Click on engine starter rubs on ratchet wheel. *Fifth.* Revolving armature touches face of magnet cores.

To Fix It.—First. Set gear wheels so that the teeth will not bottom in each other, yet not too loosely. *Second.* First oil, and if this does not make them go easier loosen the centre screws. *Third.* Increase the tension on the spring, 8, on the engine starter. *Fourth.* Reset revolving armature $\frac{1}{64}$th of an inch away from the face of the cores. In doing this be careful not to turn the armature around on the shaft, as it must be adjusted in relation to the break, as previously described.

FINGER KEYS STICKING DOWN. — *Probable Cause.—First.* Arms bent. *Second.* Dust.

To Fix It.—Work it up and down rapidly with the finger.

Parts.

All defective or broken parts should be sent

to the Superintendent at New York, and new ones be returned.

If inspectors will carefully read and follow these instructions, which are the result of experience, they will save themselves much trouble. Do not attempt to file, bend or tinker with the parts, as new parts can be supplied from New York.

Batteries.

The battery used with these instruments is that known as the Baltimore Battery. It is a modification of the gravity battery, on the same principle as the Hill and Callaud. Each cell consists of—1st. A glass jar. 2d. A copper strip, corrugated and formed into a circle, which lies at the bottom of the jar, and connected with a copper wire, insulated, which passes out and connects with the next cell. 3d. A zinc casting in the shape of a wheel without the rim, and three arms by which it is suspended at the proper height. 4th. A glass tube, which passes through a hole in the centre of the zinc, and has its lower end stopped by a cork, in which are cut large notches. 5th. A connecting screw, which is attached to one of the zinc arms, and answers the purpose of holding up

the zinc, and also connects it with the copper of the next cell. 6th. Two pins to put in the holes of the other two zinc arms, thereby assisting in holding the zinc up to the proper level.

Quantity of Battery Required.

For the local batteries which work the "engine" and the "press magnets" use the large size or "local" cells. For the main circuit which works the escapement magnet use the small size or "main" cells. The only difference is in the size.

Put three cells local on the printing magnet, and three cells on the engine, on each instrument.

In calculating amount of main battery required, allow five cells for each instrument in the circuit, and five cells for each mile of line, provided ordinary telegraph wire is used. If the resistance of your line exceeds fifteen ohms per mile you may need more main battery than the above.

This rule holds good only for short lines; on lines of four or five miles and over the number of cells may be reduced.

Putting up the Battery.

Place the glasses in position and fill them with pure water to within three inches of the top.

Throw into each cell a quarter of a pound of sulphate of zinc, and stir it up well, so as to dissolve it as much as possible. Place the copper in the bottom of the cell, allowing the insulated wire to hang out on one side.

Put the two pins into the holes in the two arms of the zinc, and attach the binding screw to the other arm at the same height as the holes with the pins in. Suspend the zinc in the cell, the two pins and the binding screw resting on the edge of the glass.

Place the cork in the bottom of the glass tube, having first cut four large notches in the sides of it (the cork)—they should be large enough to let your little finger pass through into the tube.

Now fill the tube half full of lumps of blue vitriol, and place it in the cell, letting it pass through the hole in the zinc and rest on the bottom of the jar.

Then connect the whole battery up on "short circuit" and let it remain so for two days, taking

care to replenish the tube with lumps of blue vitriol every day. It will sometimes take more than two days to bring the battery up to the proper strength.

Keeping the Battery in Order.

The action of the battery is as follows:

The blue vitriol in the tube is dissolved, and the solution descends through the notches in the cork and spreads out over the bottom of the cup. When the battery is kept closed the blue solution will generally rise about half an inch, or an inch at most, and as the lumps of blue vitriol in the tube dissolve, more should be added, and the tube should never be allowed to stand without any in it.

It is not advisable to fill this tube with lumps above the water line, as they sometimes cake together at the surface of the fluid, and the consequence is the tube may appear to be full, looking at it from the top, while in reality there is only a crust of blue vitriol there, and none at the bottom to keep up a supply in the jar.

To make sure of its condition, examine the tube through the sides of the jar. If the liquid is too

dark to do this poke a stick down into the tube gently, and if it is not full you will break through the crust, and can then put in more lumps.

It is not necessary the blue vitriol should be in lumps, but it is better. If there is powdered material with the lumps it can all be put in together. When in working order, the liquid lying *above* the solution of blue vitriol in the jar will consist of sulphate of zinc dissolved in water. When this solution is too weak the battery will not be strong enough to work; on the other hand, when it becomes too strong it also weakens the battery; therefore, it is important to know its condition at any time, which can be done with the "standard hydrometer" furnished (in a case) with the battery.

The stronger the solution of sulphate of zinc the higher will the hydrometer rise in it. When the top of the stem just shows above the surface the solution is strong enough to work. When the shoulder of the bulb appears at the surface the solution is getting too strong, and should be diluted. To do this, draw off about two inches of it, and fill up carefully with water.

The most troublesome feature in the battery is the formation of efflorescent crystals of sulphate

of zinc on the edge of the glass above the liquid; they should be cleaned off as they accumulate, and saved to start new batteries with.

Owing to a battery being too much on open circuit the blue solution will sometimes rise till it reaches the zinc. In this case the battery should be short-circuited over night, which will bring it down.

About once in three months the zinc should be carefully lifted out of the jar without disturbing the liquid, and the black scale and deposit knocked or scraped off. Then return the zinc carefully as it was.

When the water in the jar evaporates it should be replenished by pure water. The copper at the bottom will become covered with a mass of metallic copper; this will do no harm till it becomes so large as to be in the way, when a new copper must be put in. The old copper with its deposit is valuable, and must be kept and sent to New York from time to time as it accumulates.

About once a year the whole battery should be taken down, cleaned and put up anew.

When a good many cells of this battery are in use, new cells can be started at once in full strength in the following way:

When the upper solution in the cells becomes too strong, as shown by the hydrometer, and a portion is drawn off (as before mentioned), that portion, instead of being thrown away, should be saved and thrown into a tight keg or barrel, where it may accumulate till needed. Then, when putting up a new battery, instead of putting in pure water and sulphate of zinc, put in two parts (by measure) of water and one part of the solution from the keg or barrel. You will then find the battery will be strong enough to work in half an hour after setting up.

Names of the Parts.

1 Large Base.
2 Key Plate.
3 Key Plate Screw.
4 Long Key.
5 Short Key.
6 Starting Rod Button.
7 Starting Rod.
8 Starting Rod Spring.
9 Starting Rod Guide Post.
10 Bridge,
11 Centre Piece Screw.
12 Small Intermediate Gear.
13 Jam Nut for Gear Shaft Centre Screw.
14 Gear Shaft Centre Screw.
15 Centre Piece.
16 Large Intermediate Gear.
17 Intermediate Bracket.
18 Intermediate Gear Centre Screw.
19 Break Wheel Bracket Screw.
20 Switch Spring Holder.
21 Switch Springs.
22 Switch Springs Screw.
23 Switch Break.
24 Switch Break Screw.

25 Return Bindpost Screw.
26 Printing Bindpost Screw.
27 Ground Bindpost Screw.
28 Engine Bindpost Screw.
29 Main Line Bindpost Screw.
30 Bridge Screw.
31 Stop Lever.
32 Driving Ratchet.
33 Large Gear (loose).
34 Large Gear (fast).
35 Large Gear Spring.
36 Large Gear Sleeve.
37 Gear Shaft Collar.
38 Gear Shaft.
39 Driving Click.
40 Driving Click Spring.
41 Driving Click Screw.
42 Driving Click Spring Screw.
43 Stop Lever Pin.
44 Stop Lever Collar Set Screw.
45 Gear Spring Screw.
46 Stop Lever Collar.
47 Gear Spring Adjusting Screw.
48 Main Break Gear.
49 Main Break Wheel.
50 Set Screw for Main Break Shaft Centre Screw.
51 Main Break Lever Spring.
52 Main Break Lever Hook.
53 Main Break Shaft Centre Screw.
54 Main Break Lever.
55 Main Break Spring Holder.

56 Connection Screw for Main Wires.
57 Main Break Lever Adjusting Screw.
58 Main Break Bracket
59 Main Break Springs.
60 Main Break Bindpost.
61 Main Break Bindpost Screw.
62 Main Break Insulator Screw.
63 Main Break Insulator.
64 Type Wheel Shaft Centre.
65 Type Wheel Shaft.
66 Star Wheel.
67 Unison Worm.
68 Unison Pin.
69 Type Wheel Hub.
70 Type Wheel.
71 Type Wheel Set Screw.
72 Type Wheel Sleeve.
73 Type Wheel Set Screw.
74 Type Wheel Shaft.
75 Type Wheel Shaft Centre.
76 Paper Reel Stud Nut.
77 Ink Roller Sleeve.
78 Paper Reel Stud.
79 Paper Reel Arm.
80 Brass Girder Sleeve (short).
81 Heavy Frame.
82 Ink Roller Rubber Flange.
83 Ink Roller.
84 Ink Roller Girder Screw.
85 Ink Roller Arm.
86 Unison Arm.

87 Unison Arm Pin.
88 Unison Shoe Screw.
89 Brass Girder Sleeve (long).
90 Brass Girder Screw.
91 Unison Shoe.
92 Unison Arm Hook.
93 Unison Spring.
94 Escape Lever Spring.
95 Paper Reel Arm Screw.
96 Escape Lever Adjusting Thumb Nut.
97 Cut Out Wire.
98 Cut Out Wire Insulation.
99 Cut Out Wire Holder.
100 Escapement Magnet Adjusting Screw.
101 Cut Out Wire Set Screw.
102 Jam Nut for Magnet Adjusting Screws.
103 Centre Screw for Type Wheel Shaft.
104 Set Screw for Type Wheel Centre Screw.
105 Paper Driving Girder.
106 Stage Piece.
107 Paper Girder Fast Sleeve.
108 Paper Drum.
109 Upright.
110 Vibrating Spring.
111 Stage Click Screw.
112 Escapement Magnet.
113 Safety Click.
114 Paper Feed Click.
115 Paper Feed Click Screw.
116 Stage Click.
117 Paper Feed Click Spring.

118 Adjusting Post for Printing Lever.
119 Adjusting Post Nut.
120 Paper Driving Girder Screw.
121 Brass Base.
122 Light Frame.
123 Rebound Click Stud Screw.
124 Rebound Click Stud.
125 Rebound Click Spring.
126 Rebound Click Screw.
127 Rebound Ratchet Click.
128 Escapement Lever.
129 Escapement Armature Screw.
130 Escapement Armature Keeper.
131 Escapement Armature Lever.
132 Escapement Armature.
133 Escapement Lever Shaft.
134 Printing Magnet Core.
135 Printing Magnet.
136 Base Leg Screw.
137 Centre Screw Jam Nut.
138 Printing Lever Magnet Adjusting Screw.
139 Escapement Lever Shaft Centre Screw.
140 Magnet Slide Legs.
141 Cut Out Connection Wire.
142 Stage Click Spring.
143 Stage Click Spring Hook.
144 Safety Click Spring.
145 Adjusting Collar for Paper Drum.
146 Adjusting Collar for Safety Click.
147 Safety Click Hook.
148 Governor Crosshead Rivet.

149 Governor Crosshead Set Screw.
150 Governor Arm.
151 Governor Arm Rivet.
152 Governor Link.
153 Governor Spring.
154 Governor Ball.
155 Governor Sleeve Crossheads.
156 Governor Sleeve Crosshead Rivet.
157 Governor Sleeve.
158 Engine Shaft.
159 Guide for Engine Shaft.
160 Brass Top for Engine Frame.
161 Engine Break Spring Holder.
162 Engine Break Spring Holder Screw.
163 Engine Break Spring.
164 Engine Break Screw Insulator.
165 Engine Break Screw.
166 Set Screw for Engine Break Screws.
167 Engine Bindpost Screw.
168 Engine Bindpost.
169 Engine Bindpost Insulation.
170 Engine Frame Screw.
171 Engine Connection.
172 Engine Connection.
173 Engine Revolving Armature.
174 Engine Magnet Core.
175 Engine Magnet Head.
176 Engine Connection.
177 Engine Connection.
178 Engine Spool Cover.
179 Engine Frame Base.

180 Engine Magnet Keeper.
181 Engine Frame Leg.
182 Engine Magnet Connection.
183 Engine Magnet Connection.
184 Engine Shaft Collar.
185 Engine Gear.
186 Starting Ratchet.
187 Engine Gear Set Screw.
188 Set Screw for Centre.
189 Printing Lever Armature Screw.
190 Printing Lever Armature Keeper.
191 Printing Lever Side (short).
192 Limiting Screw for Printing Lever Armature.
193 Printing Lever Armature.
194 Large Curve on Printing Lever.
195 Printing Lever Shaft.
196 Printing Lever Shaft Centre.
197 Paper Spring Screw.
198 Paper Spring.
199 Printing Lever Girder.
200 Small Curve on Printing Lever.
201 Unison Tripper.
202 Twist in Tripper.
203 Pad Screw.
204 Printing Pad.
205 Adjusting Pin for Printing Lever.
206 Silk for Adjusting Spring.
207 Shield.
208 Shield Screw.
209 Upright Driving Pin.
210 Printing Lever Side (long).

A Printing Connection Wire.
B Ground Connection Wire.
C Engine Connection Wire.
D Main Connection Wire.
E Main Connection, leading to Escape Magnet.
F Main Cut Out Connection Wire.
G Main Cut Out Connection Wire.

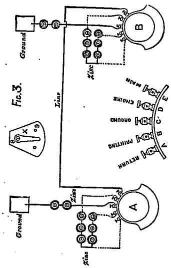


Fig. 9.

Fig. 2.

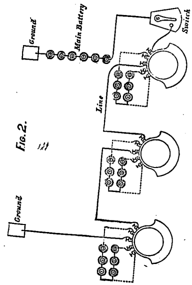


Fig. 10.

Menlo Park Manufacturing Company

This folder contains printed material issued by the Menlo Park Manufacturing Company. This company was organized in 1879 under the direction of Charles H. Lewis, Francis W. Jacobs, and William McMahon. It was licensed to manufacture Edison's Polyform, a medicinal formula that the inventor tried unsuccessfully to patent. The company abandoned the manufacture of polyform about 1881 after the business proved unprofitable.

The following items have been filmed:

1. Label from a bottle of Edison's Polyform (ca. 1880)
2. Advertising circular (ca. 1880)
3. Advertisement (Scribners, November 1880)
4. Advertisement (ca. 1880) [photocopy]

EDISON'S POLYFORM

FOR IMMEDIATE RELIEF OF

NEURALGIC PAINS

I certify
that this compound is
made according to the
formula devised by myself

Thos A Edison

EXTERNAL USE ONLY

FOR THE

RELIEF

OF

RHEUMATISM,

NEURALGIA,

SCIATICA,

GOUT,

HEADACHE,

TOOTHACHE,

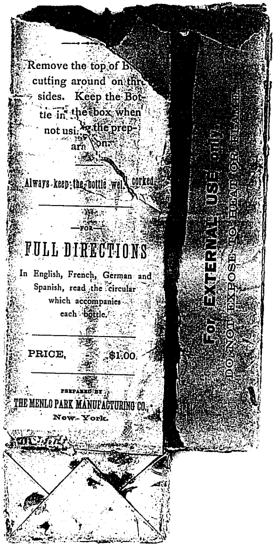
AND

ALL PAINS

WHERE THE

SKIN IS NOT

BROKEN.


Remove the top of B
cutting around on thr
sides. Keep the Bot-
tle in the box when
not usi the prep-
ar on.
Always keep the bottle wel corked.
—FOR—
FULL DIRECTIONS
In English, French, German and
Spanish, read the circular
which accompanies
each bottle.
PRICE, $1.00.
PREPARED BY
THE MENLO PARK MANUFACTURING CO.,
New-York.
For EXTERNAL USE only.
DO NOT EXPOSE TO HEAT OR FLAME

THOS. A. EDISON,

Inventor of the Electric Light, Telephone, Quadruplex, Telegraph, Stock Indicator, Electric Railway Motor, and Phonograph, Edison's Polyform, &c., &c.

(OVER.)

Prof. Edison, the world-renowned Scientist and Electrician, has been granted many patents for his inventions, but among them all, none will confer so much happiness upon mankind as

EDISON'S POLYFORM.

It was devised originally to cure himself, obtaining publicity by accident, he received so many inquiries for it that it has been put in the hands of the drug trade for sale.

EDISON'S POLYFORM is a compound to cure

NEURALGIA, RHEUMATISM,

HEADACHE and all NERVOUS PAIN,

by external application. In no case has it been known to fail in giving relief when properly used according to directions.

We append the certificate of the distinguished inventor which speaks for itself:

MENLO PARK, N. J.

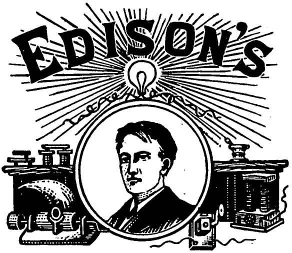
I certify that the preparation known as EDISON'S POLYFORM is made according to formula devised and used by myself.

THOMAS. A. EDISON.

SOLD BY ALL DRUGGISTS.

615.85

Scribners Mag – Nov 1880



POLYFORM

CURES

RHEUMATISM,
NEURALGIA,
SCIATICA,

And all Nervous Pains.

PREPARED BY THE

Menlo Park Manufacturing Co., New York.

PRICE, $1.00—SOLD BY ALL DRUGGISTS.

EDISON'S CURE

Thomas A. Edison's venture into the field of "electrical cures." An advertisement in "The Youth's Companion," November 10, 1881.

From "Oscar Wilde Discovers America 1882"

By Lloyd Lewis and Henry Justin Smith
(Harcourt, Brace and Company)

p-260

Sims-Edison Electric Torpedo Company

This folder contains printed material issued by the Sims-Edison Electric Torpedo Company. This company was incorporated February 16, 1886 to construct torpedoes, torpedo boats, submarines, and other instruments relating to naval warfare. Edison served as the consulting electrician and as a trustee of the company.

The following items have been filmed:

1. "Certificate of Incorporation and By-Laws" (1886)
2. "Sketch of the Sims-Edison Electric Torpedo . . ." (1886)

THE SIMS-EDISON

ELECTRIC TORPEDO CO.

THE SIMS-EDISON

Electric Torpedo Company.

CERTIFICATE OF INCORPORATION

AND

BY-LAWS.

NEW YORK:
Press of E. D. Slater, 153 to 155 Fulton Street,
1886

THE SIMS-EDISON

ELECTRIC TORPEDO COMPANY.

OFFICERS:

JOHN ANDERSON,	President.
GARDINER C. SIMS,	Vice-President.
LEWIS MAY,	Treasurer.
FRANK W. ALLIN,	Secretary.
W. SCOTT SIMS,	General Manager.
THOMAS A. EDISON,	Consulting Electrician.
GARDINER C. SIMS,	Consulting Engineer.

EXECUTIVE COMMITTEE.

WM. M. DEEN,
CHARLES BATCHELOR,
GARDNER C. SIMS.

FINANCE COMMITTEE.

LEWIS MAY, GEO. H. STAYNER,
FRANK W. ALLIN, W. SCOTT SIMS.

CERTIFICATE OF INCORPORATION.

STATE OF NEW YORK,
CITY AND COUNTY OF NEW YORK. } *ss.*

We, THOMAS A. EDISON, CHARLES BATCHELOR, GARDINER C. SIMS, W. SCOTT SIMS, LEWIS MAY, JOHN ANDERSON, WILLIAM M. DEEN, FRANK W. ALLIN and GEORGE H. STAYNER, do hereby certify as follows:

First: That we desire to form a company pursuant to the provisions of an act entitled, "An Act to authorize the formation of corporations for manufacturing, mining, mechanical or chemical purposes," passed February 17, 1848, and of the several acts extending and amending said Act.

Second: That the corporate name of the said Company is to be "THE SIMS-EDISON ELECTRIC TORPEDO COMPANY."

Third: That the objects for which the company is to be formed are as follows, to wit: The manufacture, sale and use of torpedoes, torpedo boats, submarine vessels and war ships, war materials, electric machinery and instruments, dynamo machines, electric cables, wires, motors, electric lights and all appliances for the same together with steam engines, boilers and supplies of every kind; also the purchase of letters patent of the United States and elsewhere for inventions and discoveries relating to torpedoes, torpedo boats and submarine vessels and instruments used in and about the construction, propulsion, steering, loading and explosion thereof and the application thereto of electricity and also the granting of licenses to manufacture and sell under such letters patent as may be owned by this Company.

Fourth: That the amount of the capital stock of the said Company is to be one million dollars.

Fifth: That the number of shares of which said stock is to consist is to be ten thousand of one hundred dollars each.

Sixth: That the term of the existence of the said Company is to be fifty years.

Seventh: That the number of trustees who

shall manage the concerns of the said company shall be nine.

Eighth: That the names of such trustees for the first year are Thomas A. Edison, Charles Batchelor, Gardiner C. Sims, W. Scott Sims, Lewis May, John Anderson, William M. Deen, Frank W. Allin, George H. Stayner.

Ninth: That the name of the town and county in which the business of said Company is to be carried on are the City and County of New York which is to be the principal place of business of this Company.

Witness our respective hands and seals this 16th day of February, A. D. 1886.

THOMAS A. EDISON, (L. S.)
CHAS. BATCHELOR, (L. S.)
GARDINER C. SIMS, (L. S.)
W. SCOTT SIMS, (L. S.)
LEWIS MAY, (L. S.)
JOHN ANDERSON, (L. S.)
W. M. DEEN, (L. S.)
FRANK W. ALLIN, (L. S.)
GEO. H. STAYNER, (L. S.)

In presence of

FREDERICK R. ORR.

CITY AND COUNTY OF NEW YORK, *ss.:*

On this 16th day of February, A. D. 1886, before me personally came THOMAS A. EDISON, CHARLES BATCHELOR, GARDINER C. SIMS, LEWIS MAY, JOHN ANDERSON, WILLIAM M. DEEN, FRANK W. ALLIN, GEORGE H. STAYNER to me respectively known and known to me to be the several persons who executed the foregoing certificate and respectively acknowledged to me that they executed the same.

FREDERICK R. ORR,
Notary Public, Kings County,
Certificate filed in N. Y. County.

STATE OF NEW YORK,
CITY AND COUNTY OF NEW YORK. } *ss.*

I, James A. Flack, Clerk of the City and County of New York, and also Clerk of the Supreme Court for the said City and County, the same being a Court of Record, do hereby certify, that, Frederick R. Orr, has filed in the Clerks Office of the County of New York, a certified copy

of his appointment as Notary Public for the County of Kings with his autograph signature and was at the time of taking the proof or acknowledgment of the annexed Instrument duly authorized to take the same, and further that I am well acquainted with the handwriting of such Notary, and verily believe that the signature to the said certificate of proof or acknowledgment is genuine. I further certify, that said instrument is executed and acknowledged according to the law of the State of New York.

In Testimony Whereof, I have hereunto set my hand and affixed the Seal of the said Court and County the 17th day of February, 1886.

JAMES A. FLACK, *Clerk.*

{ L. S. }

STATE OF NEW YORK,
CITY AND COUNTY OF NEW YORK. } *ss.*

I, James A. Flack, Clerk of the said City and County, and Clerk of the Supreme Court of said State for said County, do certify, that I have compared the preceding with the original Certificate of Incorporation of THE SIMS-EDISON ELEC-

TRIC TORPEDO COMPANY, on file in my Office, and that the same is a correct transcript therefrom, and of the whole of such original. Endorsed, Filed and Recorded 17th February, 1886, 10h 50m.

In Witness Whereof, I have hereunto subscribed my name and affixed my Official Seal, this 18th day of February, 1886.

{L. S.} JAMES A. FLACK, *Clerk.*

STATE OF NEW YORK,
OFFICE OF THE SECRETARY OF STATE, } *ss.*

I have compared the preceding with the original Certificate of Incorporation of THE SIMS-EDISON ELECTRIC TORPEDO COMPANY, with acknowledgement thereto annexed, Filed and Recorded in this Office on the 17th day of February, 1886, and do hereby certify the same to be a correct transcript therefrom and of the whole of the said original.

Witness my hand and the Seal of Office of the Secretary of State, at the City of Albany, this 17th day of February, 1886.

FREDERICK COOK,
Secretary of State.

{L. S.}

BY-LAWS

OF

THE SIMS-EDISON ELECTRIC TORPEDO COMPANY.

ARTICLE I.

ANNUAL AND SPECIAL MEETINGS OF STOCKHOLDERS.

Sec. 1. The Annual Meeting of the Stockholders shall be held on the second Tuesday of February in each year. Notice of such meeting shall be published in some Newspaper in the City of New York at least ten days prior thereto. Special Meetings of the Stockholders may be called as often as the Board of Trustees may deem expedient. Notice of any special meeting of the stockholders shall be given by publishing the same in some Newspaper in New York City, specifying the object of the meeting and depositing a copy of such notice in the post office, addressed to the stockholders at their respective places of

residence at least ten days before the time of such meeting. Any special meeting may be adjourned to a future day; but no new matter, not specified in the original notice, shall be introduced or considered at any adjourned meeting, except by the unanimous consent of the stockholders present or represented. No vote, resolution, or decision of the stockholders, at any meeting thereof, shall be valid, except for adjournment, unless a majority in interest of the stockholders present and represented concur in such vote, resolution, or decision.

INSPECTORS OF ELECTION.

Sec. 2. The stockholders shall, at each annual election, choose by ballot two persons to act as Inspectors. Any vacancy that may occur by the death of an Inspector, or by his refusal to serve, or his neglect to attend on the day of election, shall be supplied by the Board of Trustees.

VOTES AND PROXIES.

Sec. 3. At all elections and business meetings of the stockholders, each share shall be entitled to one vote, and may be voted upon by the holder in person or by proxy; but all proxies shall be filed with the Secretary of the Company at or previous to the time of voting.

ARTICLE II.

ELECTION OF TRUSTEES.

Sec. 1. A Board of Trustees shall be elected at each annual meeting of the stockholders of this Company to serve for one year next ensuing.

If for any reason at any annual meeting of stockholders as provided by Art. 1, Sec. 1, of these By-Laws a Board of Trustees should not be elected the Board in existence at the date of such annual meeting shall hold over until their successors are chosen or elected as herein below provided for.

A special meeting for the election of Trustees in place of those holding over may be called at any time after the annual meeting upon the written application to the Secretary, of stockholders owning at least one quarter of the capital stock of the Company and upon such application being made the Secretary must call a meeting accordingly.

Sec. 2. All vacancies in the Board of Trustees shall be filled by a majority of the Trustees remaining in office.

MEETINGS OF TRUSTEES.

Sec. 3. Stated meetings of the Board of Trus-

tees shall be held on the second Tuesday of each month. All regular or special meetings may be held at any time upon the call of the President or any four Trustees, due notice of which shall be given by the Secretary.

QUORUM.

At all meetings of the Board of Trustees five shall constitute a quorum for the transaction of business.

SPECIAL MEETINGS.

Sec. 3. No business shall be taken up or acted on at a special meeting, except that referred to in the notice of such special meeting, unless with the consent of the majority of the whole Board.

ARTICLE III.

OFFICERS.

Sec. 1. The officers of the Company shall be a President, a Vice-President, a Treasurer, a Secretary, and a General Manager.

PRESIDENT, DUTIES OF.

Sec. 2. The President shall, if present, preside

at all meetings of the Stockholders and Trustees; he shall be ex officio member of all standing committees; he shall also attend the meetings of any special committee when requested by the Chairman.

Sec. 3. It shall be his duty to sign all deeds, contracts, or other instruments in writing entered into by or on behalf of the Company when the Executive Committee so direct or approve or authorize the same to be done; to sign all certificates of stock and affix thereto the seal of the Company to all instruments in writing when the Board shall so authorize and order; and, generally, he shall perform all the acts incidental to the office of President, and all and any acts which the majority of the Board may direct by vote at any meeting.

Sec. 4. The President shall have exclusive charge of the corporate seal of the Company.

VICE-PRESIDENT, DUTIES OF.

Sec. 5. In the absence of the President his duties shall devolve upon the Vice-President; and if both President and Vice-President should be absent, the Board shall elect a President pro

tem, who shall have and exercise the powers of President until the President or Vice-President resumes his duty.

TREASURER, DUTIES OF.

Sec. 6. The Treasurer shall have the custody of all the funds of the Company, and shall keep them in such bank or other depository as the Trustees shall designate, in the name of the Company. He shall sign receipts and acknowledgments for all money and other property of the Company which may come into his hands, and disburse and appropriate the same only under the direction and with the sanction of the President, in pursuance of the By-Laws. He shall render a full and particular statement of his cash accounts, accompanied with vouchers, at every annual meeting of the Company, showing the condition of its financial affairs, and a similar account at every regular or special meeting of the Stockholders, when required by a vote thereof so to do. He shall also render a statement of the accounts of the Company to the Board of Trustees at their regular meetings, and at their special meetings, when so required by vote of the Board.

Sec. 7. No money shall be withdrawn from the bank or other depository of the Company, except on the check of the Treasurer, countersigned by the President; and in the absence of the President, the same shall be countersigned by the Vice-President or President pro tem.

SECRETARY, DUTIES OF.

Sec. 8. The Secretary shall notify the Stockholders and Board of Trustees of all the special meetings, and shall record the proceedings of all their meetings in a book to be kept for that purpose, and shall conduct the correspondence of the Company under the direction of the President or Trustees, and shall perform such other duties appertaining to his office as may be assigned to him by the Board of Trustees, or by the President.

Sec. 9. In the absence or disability of the Treasurer or Secretary, the Board of Trustees shall appoint a Treasurer or Secretary pro tem who shall have and exercise the powers of Treasurer or Secretary, until the Treasurer or Secretary, resumes his duty.

ARTICLE IV.

Sec. 1. There shall be an Executive Committee, composed of three members of the Board of Trustees, which shall (with the aid of the Secretary, when requested) keep a record of its proceedings, to be submitted to the Board at each regular meeting of the Board, or as often as may be required by the Board. A majority of the Committee shall constitute a quorum. It shall make its own rules and regulations, not inconsistent with the By-Laws of the Company. Such Committee shall be chosen, and vacancies therein filled by the Board of Trustees. It may be called together by the Chairman, or by any two members thereof, for special business.

Sec. 2. The Executive Committee shall advise with and aid the officers of the Company in all matters relating to or touching its interests.

Sec. 3. It shall employ all necessary employees, and shall fix the amount of salary to be paid to any officers or employees of the Company.

Sec. 4. It shall have charge and direction of all the details of, and have the general management of the business of the Company, and shall

report at the regular meetings of the Board of Trustees.

Sec. 5. The appointments made by, and all other acts of the Executive Committee, shall be subject to the approval and ratification of the Board of Trustees.

ARTICLE V.

Sec. 1. There shall be a Finance Committee, composed of four members of the Board of Trustees which shall (with the aid of the Secretary, when requested) keep a record of its proceedings, to be submitted to the Board at each regular meeting of the Board, or as often as may be required by the Board : A majority of the Committee shall constitute a quorum : It shall make its own rules and regulations, not inconsistant with the By-Laws of the Company. Such committee shall be chosen, and vacancies therein filled by the Board of Trustees. It may be called together by the Chairman, or by any two members thereof for special business.

Sec. 2. The Finance Committee shall superintend all the financial operations of the Company and shall meet at least once in each month to

examine the books and vouchers of the Company, subject to the approval of the Board of Trustees and shall make full reports monthly of the financial condition of the Company.

Sec. 3. All acts of the Finance Committee shall be subject to the approval and ratification of the Board of Trustees.

AUDITING COMMITTEE.

Sec. 4. At the close of each fiscal year the accounts and assets of the Company shall be examined by the Finance Committee and the report of such Committee shall be placed on the minutes.

ARTICLE VI.

ORDER OF BUSINESS.

Sec. 1. The following order of business shall be observed at the stated meetings of the Board:

1. Roll-call.
2. Reading Minutes of Previous Meeting.
3. Reports of Standing Committees.
4. Reports of Special Committees.

5. Reading Communications addressed to the Board or its officers.
6. Deferred and Unfinished business.
7. Treasurer's Report.
8. New Business.
9. Adjournment.

SPECIAL COMMITTEES.

Sec. 2. All Special Committees shall be appointed by the President, unless otherwise specially ordered by the Board.

ARTICLE VII.

ISSUE AND TRANSFER OF STOCK.

Sec. 1. The Certificates of Stock, shall be numbered and registered as they are issued in some financial institution located in the City of New York to be designated by the Board of Trustees; they shall exhibit the holders name, and the number of shares, and shall be signed by the President or Vice-President, and countersigned by the Secretary, and shall bear the corporate seal. Transfers of stock shall only be made on the books of the Company, in the pre-

sence of the Secretary or other authorized agent of the Company, either by the holder in person or by attorney; and the possession of a Certificate of Stock shall not be regarded as vesting any ownership of the same in any other than the person in whose name it is issued, (as between the Company and such other holder) until the transfer is duly made on the books of the Company as aforesaid.

CERTIFICATES PRESENTED FOR TRANSFER TO BE CANCELLED.

Sec. 2. When a Certificate is first presented for transfer to the President or authorized agent of the Company, the same shall be cancelled.

DISPOSITION OF CANCELLED CERTIFICATES.

Sec. 3. The Cancelled Certificate shall be pasted on the margin of the book from which it was taken when originally issued.

LOST OR DESTROYED CERTIFICATES.

Sec. 4. If any person claim a Certificate of Share of the Capital Stock of this Company, to be

issued in lieu of one lost or destroyed, he shall make an affidavit of the fact, and state the circumstances of the loss or destruction; and he shall advertise in one or more of the public newspapers of the City of New York, to be designated by the President, for the space of six weeks, an account of the loss or destruction, describing the Certificate, and calling upon all persons to show cause why a new Certificate should not issue in lieu of that lost; and he shall transmit to the Company his affidavit, and the advertisement before mentioned and proof of its publication, and give the Company a satisfactory bond of indemnity.

ARTICLE VIII.

TRANSFERS OF STOCK.

Sec. 1 Transfer of Stock shall be made on the books of the Company by the holder in person or by attorney. No stock can be transferred unless by surrender of the Certificate representing the same.

TRANSFER BOOK, WHEN TO BE CLOSED.—DIVIDEND TO WHOM TO BE PAID.

Sec. 2. The Transfer Book shall be closed ten days previous to the Annual Meeting of the Stock-

holders, and to the meeting for the election of Trustees, and to the payment of any dividend. And no dividend shall be paid except to the Stockholders registered as such at the time of the closing of the books.

SEAL OF COMPANY.

Sec. 3. The Company shall have a common seal, with such inscription as shall be approved by the Board of Trustees.

DIVIDENDS.

Sec. 4. The Trustees shall declare dividends of the profits of the Company, whenever they deem it expedient, of which due notice may be given in such manner as the Board shall direct.

DIVIDENDS MAY BE WITHHELD.

Sec. 5. It shall be competent for the Board of Trustees to withold any dividend declared due to any stockholder indebted to the Company.

ARTICLE IX.

These By-Laws may be altered or amended at any regular meeting of the Board of Trustees, notice thereof having been given at a previous meeting, in writing, of the alterations proposed.

SKETCH

OF THE

SIMS-EDISON ELECTRIC TORPEDO,

HISTORICAL, DESCRIPTIVE, AND ILLUSTRATIVE

OF

ITS EFFICIENCY FOR HARBOR AND COAST DEFENSE,

AND

ITS APPLICABILITY TO NAVAL WARFARE;

WITH

OFFICIAL CHARTS AND DESCRIPTIONS

OF

TESTS, TRIALS AND RUNS,

MADE BY THE

BOARD OF ENGINEERS OF THE U. S. ARMY.

THE SIMS-EDISON ELECTRIC TORPEDO COMPANY,
NEW YORK.

SUBMARINE ELECTRICAL FISH TORPEDO.

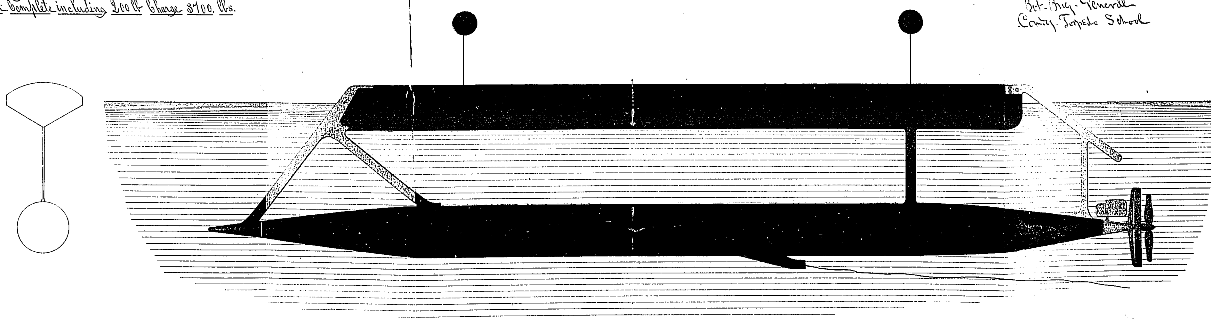
CONSTRUCTED BY

THE SIMS ELECTRIC TORPEDO CO. N. Y.
U. S. A.

Diam. of Hull	18in's
Length do.	28 feet
Length of Float	20. "
Length of Cable	6000. "
Weight Complete including 200 lb Charge	3700. lbs.

Speed 10 to 11 miles per hour as per Official Government tests under the direction of Gen. H. L. Abbot. U.S.A. at Willets Point N. Y. Harbor.

Henry L. Abbot
Lieut. Colonel of Engineers
Bvt. Brig. General
Comdg. Torpedo School



THE

Sims-Edison Electric Torpedo Company,

NEW YORK.

OFFICERS.

JOHN ANDERSON, *President.*
GARDINER C. SIMS, *Vice-President.*
LEWIS MAY, *Treasurer.*
FRANK W. ALLIN, *Secretary.*
W. SCOTT SIMS, *General Manager.*

THOMAS A. EDISON, *Consulting Electrician.*
GARDINER C. SIMS, *Consulting Engineer.*

COUNSEL.

FULLERTON & RUSHMORE, New York.
CHAS. H. WOODRUFF, New York.
DAVID S. BAKER, JR., Providence, R. I.

EXECUTIVE COMMITTEE.

WILLIAM M. DEEN, CHARLES BATCHELOR,
GARDINER C. SIMS.

FINANCE COMMITTEE.

LEWIS MAY, FRANK W. ALLIN,
W. SCOTT SIMS, GEORGE H. STAYNER.

REGISTRAR OF STOCK,
AMERICAN LOAN AND TRUST CO. OF NEW YORK.

The Sims-Edison Electric Torpedo.

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1. The Situation and its Problem.

The Improvements that have been made in recent times, in ordnance and in naval architecture, have completely revolutionized the methods and systems of coast and harbor defense. Rifled cannon of long range, and armored ships of war rapidly moved by steam, have rendered coast and harbor defenses, that were once considered impregnable, as worthless for defense and as impotent for offense, as if they were children's toys. And the problem that is now being anxiously pondered in all countries that have a more or less extensive seaboard, and important centres of commerce and population, is the crucial one, how to protect these from the assaults of possible or actual hostile navies.

It must be plain to all practical men that a nation whose defenses are powerless against the guns and navies of other nations is in no condition to treat on terms of equality, much less of advantage, with such nations, and is at their mercy—so far as its seacoasts and the large cities which line it are concerned—in time of war. The great cities on its seaboard, which are the entrepots of supply and distribution for its people, are constantly menaced with the possibility of destruction, and the people themselves with the certainty of being laid under contribution by an enemy in case of war. A nation and people thus defenseless can neither negotiate as advantageously as they might in time of peace with a nation and people well provided with offensive machinery, nor successfully cope with them in time of war.

While this state of the case is so obvious as to need neither argument nor illustration as respects those nations whose people are averse, and whose institutions are unfriendly to the maintenance of large naval forces, and who therefore keep this arm of the national defense at the minimum, it is scarcely less obvious as relates to nations which maintain the largest, most powerful, and most perfectly equipped navies. For, however numerous and powerful the fleets may be of any country having an extended seaboard and exposed cities and harbors, one or more of innumerable causes arising from accident, from carelessness, from treachery, from incompetency, from storms, or from the menacing presence of an enemy in some other vulnerable quarter, may combine to leave a vital point exposed, which, if insufficiently protected may be destroyed and the adjacent country devastated or laid under contribution. This contingency is especally full of danger if the enemy is skillful, daring and active, and one who would not hesitate to sacrifice himself if he could thereby inflict a blow upon his adversary, involving loss of far greater magnitude than his country would suffer from his own destruction.

That this is not an exaggerated statement, so far at least as relates to the United States, and that it does not originate in the heated imagination of an alarmist, but substantially reflects the views of the calmest and most deliberate thinkers of the day, is manifest from the recent letter of Hon. Samuel J. Tilden to Hon. John G. Carlisle, Speaker of the House of Representatives. Says that able and proverbially cautious thinker and statesman, under date of December 1, 1885:

The property exposed to destruction in the twelve seaports—Portland, Portsmouth, Boston, Newport, New York, Philadelphia, Baltimore, Charleston, Savannah, New Orleans, Galveston and San Francisco—cannot be less in value than five thousand millions of dollars. To this must be added a vast amount of property dependent for its use on these seaports. Nor does this statement afford a true measure of the damage which might be caused to the property and business of the country by a failure to protect these seaports from hostile naval attacks. They are the centres, not only of foreign commerce, but of most of the internal trade and exchanges of domestic productions. To this state of things the machinery of transportation of the whole country has become adapted. The interruption of the currents of traffic by the occupation of one or more of our principal seaports by a foreign enemy, or the destruction of them by bombardment, or the holding over them the menace of destruction for the purpose of exacting contribution or ransom, would inflict upon the property and business of the country an injury which can neither be foreseen nor measured. The elaborate and costly fortifications, which were constructed with the greatest engineering skill, are now practically useless. They are not capable of resisting the attacks of modern artillery.

A still greater defect exists in our coast defenses. The range of the best modern artillery has become so extended that our present fortifications, designed to protect the harbor of New York, where two-thirds of the import trade and more than one-half of the export trade of the whole United States is carried on, are too near to the great populations of New York City, Jersey City and Brooklyn to be of any value as a protection. To provide effectual defenses would be the work of years. It would take much time to construct permanent fortifications. A small provision of the best modern guns would take several years. Neither of these works can be extemporized in presence of emergent danger. A million of soldiers, with the best equipments, on the heights surrounding the harbor of New York, in our present state of preparation, or rather in our total want of preparation, would be powerless to resist a small squadron of war steamers. This state of things is discreditable to our foresight and to our prudence.

The best guarantee against aggression, the best assurance that our diplomacy will be successful and pacific, and that our rights and honor will be respected by other nations, is in their knowledge that we are in a situation to vindicate our reputation and interests. While we may afford to be deficient in the means of offense, we cannot afford to be defenseless. The notoriety of the fact that we have neglected the ordinary precautions of defense invites want of consideration in our diplomacy, injustice, arrogance and insult at the hands of foreign nations.

2. Coast and Harbor Defense

The problem of Coast and Harbor Defense, which, as has been seen, was forced upon the attention of the maritime and commercial nations of the world by the revolution that had taken place in ordnance and naval construction, has been studied with the gravest solicitude, for the last quarter of a century, by the leading military men of Europe and America; but nowhere—and for obvious reasons—has it been pondered with as profound solicitude, and even anxiety, as it has been by the military and naval officers, and the scientists and inventors, of the United States of America.

Among the earliest conclusions, reached with substantial unanimity by all who have been engaged in the solution of this grave problem, are these: That all hitherto existing coast and harbor fortifications and defenses are utterly worthless as a means of resistance to the offensive appliances of modern warfare. And that the powerful war-vessels propelled by steam, rendered almost invulnerable to shot and shell by steel armor, and armed with long-range rifled cannon of enormous calibre, which are now built or are in process of construction, can pass unharmed any fort which has been, or, in the present state of military and engineering skill, can be constructed.

With equal unanimity they have also reached the conclusion that the torpedo is destined to enter largely into all future naval wars, and become, to a great extent, one of the most potent weapons, both offensive and defensive, in all wars in which fleets engage at sea, or coasts and harbors are defended. And further, that by the use of its combined forms in association with other permanent or movable defenses, an exposed coast-line or a harbor can be successfully defended against the most powerful guns and ships that modern skill and science have been able to perfect.

Before arriving at these conclusions an exhaustive study had been made of all the known forms of torpedo, having reference especially to the intrinsic and comparative value of each, to its efficiency either singly or in combination with other forms, and to its potency for offensive warfare at sea, or as a means both offensive and defensive for the protection of harbors and fortifications.

As a preliminary step, this study involved a careful consideration of the questions, What is required or expected of the *torpedo system*, with special reference to Coast and Harbor Defense? What are the elements of strength or weakness of the particular forms of torpedo that have been devised and perfected?

3. What is Required—Elements of Strength.

The results of this inquiry may be briefly stated, as follows:

To be thoroughly effective the *torpedo system* must be equally reliable and serviceable for *offense* and *defense*. It must not only render the approaches to coast and harbors, and movements in the harbors themselves, slow, difficult, and dangerous, through the instrumentality of *fixed mines*, or torpedoes, which explode on contact, or by concussion, or otherwise. But as these are stationary, non-intelligent, and more or less easily removed or avoided by the ingenious devices that have been invented, and with which war vessels are provided, and therefore a temporary and imperfect defense only, they should be supplemented for their own preservation and also for the destruction of an enemy who may undertake to remove or avoid them, by a torpedo which combines the qualities

of being *movable,* easily *portable, invisible* to an enemy, *indestructible* by shot or shell, *certain* of operation, which can be *projected* from a long range with a speed equal to or greater than that of a steam war vessel, whose *movements* throughout its entire course can be *intelligently controlled* at will from a place of comparative safety, and which explodes at the will of its operator at the point *below* the armor of a ship of war where its discharge will produce the most destructive consequences. It should also be so cheap and so easily handled, as compared with the cost and the vast weight of heavy ordnance, that it may be multiplied indefinitely, at an economy of time and money, and a proportionate increase of offensive and defensive power.

4. Elements of Weakness—Instances.

The *fixed-mine* torpedo, as its name implies, is a mine or magazine of powder or other explosive, which is fixed or anchored in the channel of a river, or in a harbor, the object being to explode it by the war vessel striking it or its attachments, or by means of an electric current from the shore when the vessel passes over it. The fact that this form of torpedo and its application to harbor defense, have stimulated inventors and military and naval officers to expend great labor and study in more or less successful efforts to discover some practical appliances for protecting and defending or for removing, overcoming, or destroying it, proves its genuine worth.

The weak or defective points of torpedoes of this kind are as follows: (1.) They are liable to be moved out of position, and their electric cables and other attachments disarranged by the force of currents or heavy seas, this being especially the case if they are suspended. (2.) Their electric cables and other attachments may become useless and inoperative through corrosion and decay, from prolonged immersion in salt water. (3.) The explosion of one will explode others if in close proximity, and if not so placed they are of less value as an effective bar to the passage of a hostile vessel up or down the channel or harbor. (4.) To be hurt by a fixed mine torpedo, a vessel must come to it, which fact greatly lessens the sphere of its usefulness. (5.) A hostile vessel may clear a path for itself by sending a steam launch ahead to drop overboard other mines, which may be exploded after the launch has retired to a place of safety, and the concussion thus caused will explode all other fixed mines within a radius of from 50 to 100 feet (according to the power of the charge exploded), and open an unprotected roadway of from 100 to 200 feet in width, through which the largest ironclad can steam in perfect safety. Of course a channel thus cleared becomes an open and safe roadway for the hostile fleet that may follow in the track of the pioneer vessel, since other mines cannot be put in position to replace those destroyed soon enough to be of use.

Surface Torpedoes, that is to say, those which travel on the surface of the water, are of very little use, no matter how completely they may be under control, since by the interposition of rafts, cables, spars, etc., an enemy can prevent them from reaching their vessel. They can also be easily destroyed; one shot from a Gatling or a Hotchkiss gun, striking such a torpedo, being sufficient to disarrange its machinery or to sink it. Moreover, even if it exploded close to an armored ship, the explosion being on the surface, at the point where its armor affords protection, any damage the surface torpedo would inflict would necessarily be comparatively slight.

The *Self-Propelling Torpedo,* or the torpedo which contains within itself its propelling power, whether it be gas or compressed air, is uncertain in its movements, and its motive power being limited in quantity is gradually but inevitably exhausted, and the torpedo becomes inoperative, inert, and ceases to move. This is self-evident, since, as the power is applied, the stock of gas or compressed air on board constantly grows less, and the torpedo generally slows down as it approaches an enemy, thereby presenting a good mark for his guns and being easily put *hors de combat.* Moreover, practical tests and trials of such torpedoes have shown that they are often even more dangerous to friend than foe, gas, in particular, being very intractable and difficult to handle, and not infrequently causing the torpedo to return, like a boomerang, to the vessel that sent it out.

The *Projectile Torpedo,* or one that is shot from a gun or projected in any other way, passes instantly out of the control of its operator, is very uncertain in its movements, and if shot under water is more likely to glance aside or to return to its point of departure than to strike the hostile vessel at which it was aimed, certain conditions of currents and tides imparting to it a boomerang direction, as in the case of the *Self-Propelling Torpedo.*

These several forms of torpedo are severally represented, in the order above named, by the kinds known as the *Spar-Torpedo boat,* the *Lay Torpedo,* and the *Whitehead Torpedo*—the first being a surface torpedo operated by a crew on board; the second a self-propelling surface torpedo impelled by gas stored on board; and the third a combination of the projectile and the self-propelling torpedo, moved by compressed air stored within itself. Besides the defects already detailed, these others may be stated: The efficiency of the *Spar-Torpedo Boat* depends upon the concerted action and efforts of a crew who are placed in an eminently hazardous position, and most emphatically constitute a "forlorn hope." The *Lay Torpedo,* being moved by power stored within itself, cannot be recalled after its stored power is expended; its speed and power steadily decrease from the time of its departure till the critical moment when both are most essential; and it must be stored on the deck or other exposed parts of a vessel, and is, therefore, a constant and menacing danger to a crew and ship in time of action. Finally, the effective range of the *Whitehead Torpedo* is only about 1,500 feet, and for this reason alone, even if there were no other, is practically useless.

5. The Sims-Edison Electric (Fish) Torpedo.

In the Sims-Edison Electric Torpedo, all the requisite elements of strength, convenience, and efficiency are united that have been above shown to be essential,

and all the defects and weaknesses are remedied so completely that, in its own sphere and within the scope that is claimed for it, it meets every requirement, while if associated with a reliable and effective *fixed mine* torpedo as an auxiliary, it forms a perfect system of harbor and coast defense, impregnable by any means that military and naval science have been able to devise.

The purpose of this pamphlet is to invite attention to this powerful offensive and defensive weapon of submarine warfare, and especially to the conclusive evidence that is appended hereto, consisting of the official reports of the Board of Engineers and others of the United States Army, establishing the facts that it embraces the greatest, most important and most valuable discoveries and improvements yet devised in topedoes, and that it forms the most powerful and efficient instrument in existence for offensive warfare at sea, and for both offense and defense in the protection of coasts and harbors.

6. Description of the Sims-Edison Torpedo.

The Sims-Edison Electric Torpedo from its shape and its facility of movement under water in every desired direction, popularly known as the *Fish-torpedo*, is a submarine boat with a *cylindrical hull* of copper and conical ends, either 28 feet long by 18 inches in diameter for one mile service, or 28 feet long by 21 inches in diameter, for two-mile service, made in four parts or sections united by means of lock-joints, and supplied with a screw propeller and rudder.

The hull is supported at a submerged depth by an *indestructible float*, which is attached to the hull by an upright steel stanchion. Placed fore and aft on the hull are *two rods* for showing signal-flags, balls or lights, which rods are hinged at the base with a spring-hinge so as to assume an oblique or horizontal position when meeting and moving under an obstruction, and to recover their upright position automatically when the obstruction is passed.

Both *hull* and *float* are protected from cables, ropes or other obstructions by a sharp steel blade, which runs from the bow of the hull to the top of the float and from the stern of the float to the stern of the hull, and is set at such an angle as to make the torpedo dive under or cut through any obstacle. This device makes it possible to use the Sims-Edison Torpedo among friendly boats or floating logs, ropes, cables or ice, with no risk of explosion, save when desired. This is possible only with this torpedo.

The Sims-Edison Torpedo is very *simple* and *compact* in its construction. It weighs, all told, from 3,000 to 4,000 pounds, according to the distance to be overcome, but no single part or section weighs more than 800 pounds. It can be taken apart and put together again in less than fifteen minutes; and its entire construction greatly facilitates its handling, transportation, and storage on a vessel of war or elsewhere. Copper and brass are employed in its construction, to avoid the rust and corrosion that would soon render a torpedo made of iron or steel useless, even if the iron is galvanized—steel being even more perishable from this cause than iron.

The *power* by which this torpedo is propelled, guided and exploded is *electricity*, generated by a dynamo-electric machine on shore or on shipboard, and therefore is practically *inexhaustible*. This torpedo is the only one that is driven by a power *not* within itself.

The bow section of this torpedo contains the explosive charge, which varies from 250 to 400 pounds of dynamite, according to the size of the torpedo.

The *electric current* produced by the dynamo machine is conveyed to the torpedo by a cable stored in one of its sections, which is paid out as the torpedo proceeds on its errand. The electric current is constant in supply, unlimited in amount, and at all times under the complete control of the operator by means of a key-board. The operator from his station on shore or on shipboard, can, at will, start, stop, or steer the torpedo to port or starboard, and explode the charge, which can also be arranged to explode by contact, if desired; and he receives notice when the hull or blade meet with any obstruction, together with the magnitude of the same, thus making sure of the proper moment for explosion.

For *Land Fortifications*, it is proposed to have the Sims-Edison Torpedo anchored by means of electric cables, at different parts of ports, or in bomb-proof canals with lock-gates, where also will be placed the steam-engine, boiler, dynamo machine, and the operators for working them. The operators will receive orders by telephone or otherwise from sentinels, pilots, or watchmen stationed for that purpose. In such cases the operators and the machinery for generating and transmitting the power, will at all times be in a place of safety, and the torpedo and its appurtenances under complete control.

For *Naval Offensive Purposes*, it is proposed to have one or more of the Sims-Edison Torpedoes travel, *with its own power*, about 100 feet ahead of or off from the side of a steam war-vessel, attached to the vessel by electric snap-cables, the pilot of the vessel having control of the movements of the torpedo. By this arrangement the Sims-Edison Torpedo may travel any required distance at sea, and when wanted for action, it may be released and *sent off at once* and *under full speed*, saving the all-important moments of time that would be consumed in launching from a vessel when preparing for action or when under fire. This manœuvre is possible only with the Sims-Edison Torpedo, for the reason that its propelling power is *not* within itself but with the operator, and, being without limit as to quantity, is never exhausted. Whereas, all other torpedoes contain their propelling power within themselves, which, being limited in amount is soon expended, and must be launched while a vessel is in front of an enemy at short range, and when preparing for action or under fire. In this connection, it should also be remarked, that while the Sims-Edison Torpedo can be used for *any* war-vessel, it is in the highest degree desirable that naval vessels should be built, whose principal armament should consist of Sims-Edison Torpedoes, and which should have sufficient speed to overtake the heavy iron-clads and then easily destroy them with the torpedo. Such a vessel would also form a

valuable agency for clearing a channel or coast line of *fixed mine* torpedoes, by the process known as countermining. *

7. Summary of Peculiar and Essential Qualities.

The special points of superiority of the Sims-Edison Torpedo over all others, as regards the elements of potency, efficiency, convenience, and thorough adaptability to offensive and defensive naval warfare, may be briefly summarized as follows :

It is movable, by a practically inexhaustible power, generated outside of itself, and transmitted from a place of comparative safety on the shore or on shipboard.

Its movements are directed and controlled, whether ahead, to port or starboard, in the direction of the altered or changing course of an enemy, or on its return when desired, by the intelligent will of an operator in a place of comparative safety—nothing being left to blind chance.

Its movement to the point required cannot be stopped by any obstructions, since it may be deflected to the right or left, or it can be made to return at will, while by its own automatic action it clears the way of cables, chains, spars or rafts, and the like, or passes under the obstructing object.

It is portable, light in weight, convenient in its dimensions, and being in four small sections is easily stored on land or on shipboard ; and it can be taken apart and put together in a few minutes.

Being entirely submerged, its hull, which carries the explosive charge, cannot be reached by shot or shell, and its float, besides being of material capable of resisting shot or shell, opposes so minute a point to any missile as to be almost invisible and practically secure from it, while it is also greatly protected when in motion by the water that dashes over it, which serves to hide it from sight and causes missiles aimed at it to glance harmlessly aside. Yet if shot or shell should penetrate the float, it is indestructible, being filled with a buoyant substance which is impervious to water and will not sink even if the outer metallic shell is partially destroyed.

It renders fixed mine torpedoes inoperative and clears the way of them for a fleet, when they are planted in an enemy's harbor ; and it protects and defends or replaces them, when in a harbor to be defended against an enemy.

It vastly increases the effective armament of a vessel of war by a new and

* In this way the Sims-Edison Torpedo may become an invaluable adjunct in offensive naval warfare. For the purpose of clearing a channel of fixed mines, etc., in order to make safe the passage of heavy war-vessels, and also to protect them from the attacks of spar-torpedo boats, the construction is advised of a heavily armored steam launch, to act as a tender to a fleet, which should be a sea-going vessel, capable of being easily and quickly manœuvred, set low in the water, having extra speed, and being of very light draught. Such a launch or tender, should be supplied with the smaller and least expensive. Sims-Edison Torpedo, without the float, and so constructed as to be able to travel any distance up to 2,000 feet. From the time it left the launch the torpedo would at all times be under the complete control of the operator, who could at will immediately sink it to the bottom and explode it, and by the concussion thus caused, would also explode and destroy any fixed mines and open a safe passage of from 100 to 200 feet for a fleet. The launch would be comparatively safe, being protected by its armor against shot or shell, and also protected by the Sims-Edison Torpedoes sent ahead, and to port and starboard, which clear a safe passage for it as well as for the heavier and more valuable vessels. It is obvious that a launch of this kind would be of prime service in effecting an entrance into an enemy's harbor, being easily handled and of light draught. The torpedoes which form its armament should be so arranged as to drop other fixed mines in place of those destroyed and return to the launch from whence these mines could be destroyed.

most destructive appliance, by whose agency a small, swift, sea-going launch may easily cope with and disable or annihilate the most powerful iron-clad.

It explodes at the precise point, underneath the surface of the water and below the armor of a vessel of war, where its discharge will be productive of the most destructive results.

Its "official" speed is greater, continuously, than that of any other form of torpedo, and steadily increases instead of steadily diminishing as it nears the vessel of an enemy.

Its course cannot be permanently diverted by tides or currents, being always under the full control of the operator throughout its entire range of two miles.

It can be stored on shipboard, below deck, comparatively out of the reach of an enemy's guns ; and as the "charge" may be put in at the moment, only when required, the vessel and crew run no greater risk of danger from its explosion than from the explosion of the "magazine" of the vessel.

8. Tests by Officers of U. S. Army.

As early as 1879, the Sims Torpedo had engaged the serious attention and study of the most distinguished military men in the United States, who were gravely apprehensive of the dangers incident upon the exposed and defenseless condition of our coasts, harbors, and large seaboard cities, with the result that it recommended itself to them by its extraordinary potency and indestructibility, the inexhaustibleness of its motive power, and the perfect control of its movements by an operator in a distant place of safety, and also by its adaptability to a wide range of application in military and naval operations. It was seen that this torpedo combined practical elements of power and efficiency, especially for coast and harbor defenses, that had been hitherto vainly sought for in any other torpedo appliance or association of appliances that military genius or scientific and engineering skill had been able to devise.

In the course of the spring and summer of 1880, a number of studies of the working of the Sims (fish) Torpedo were made by officers of the Battalion of Engineers of the United States Army, stationed at Willet's Point, New York, under the immediate personal supervision and direction of Gen. Henry L. Abbot, U. S. A., assisted by the inventor, Mr. W. S. Sims, with the particular object in view of perfecting some minor details having reference to the practical application of the torpedo in war. These practical studies were made in connection with an experimental Torpedo Boat made for the United States Government and paid for by it.

These studies, and the experiments that were conducted in connection with them, so clearly revealed the efficiency of the Sims Torpedo, that later, in the same year, on September 22 and 24, and a month later, on October 28, three official runs of it were made, respectively, by eleven and ten officers of the Battalion of Engineers, under the supervision and direction of General Abbot, Lieut.-Col. of Engineers, Brv't Brig.-Gen. U. S. A., commanding the School of Application. The "official" reports of these runs, with the accompanying charts and descriptions, are appended as follows :

OFFICIAL RUN

OF THE

SIMS ELECTRIC (FISH) TORPEDO,

Made at Willet's Point, N. Y. H., on September 22, 1880.

THE RUN was made and the records taken by eleven officers of the Battalion of Engineers, assisted by four non-commissioned officers and twelve privates.

Stations established at 15 seconds apart by chronometer, and triangulation at distant station regulated through telephone. A small error in time probably occurred at station 12.

TRIANGULATIONS made by four officers at each theodolite (base-line 1255.8 feet)—one following the fish with telescope, two reading the verniers, and one recording.

STRENGTH OF ELECTRICAL CURRENT determined by an Obach galvanometer, read by an officer.

REVOLUTIONS OF DYNAMO MACHINE automatically recorded on chronograph.

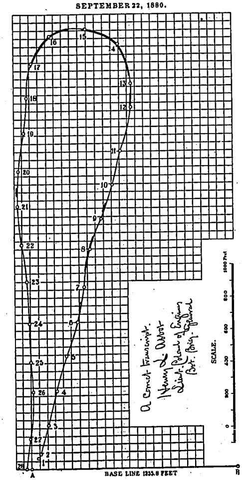
TIMES OF STEERING electrically recorded on chronograph by an officer—shown by the heavy lines on the plot of the run.

FISH TORPEDO piloted by an officer and steered by the inventor.

DETAILS OF THE RUN.

Station.	Time after starting	Dynamo Machine (Weston No. 5).		Distance between stations.	Speed per hour.	REMARKS.
		Revolutions per minute.	Current.			
No.	m. s.	Rate.	webers.	feet.	miles.	The dynamo machine began to revolve at 7″ and was stopped at 6′ and 44″ after the order was given for starting (Station 1). A fault (bare copper) showed itself in the cable near the shore end, after the run. Between stations 3 and 27, a distance of 5432 feet, the fish moved at an average rate of 10.3 miles per hour—the dynamo machine making 1151 revolutions per minute. The total number of revolutions of the screw propeller (pattern B) was 3817; the total distance traveled was 5832 feet. (552 feet over a mile.)
1	0 00	0	0	0	0	
2	15	....	28.55	31	1.41	
3	30	1102	38.02	183	8.32	
4	45	1177	42.60	217	9.86	
5	1 00	1166	45.20	224	10.19	
6	15	1177	45.57	216	9.82	
7	30	1144	40.99	220	10.00	
8	45	1154	44.30	239	10.86	
9	2 00	1133	46.11	202	9.18	
10	15	1132	46.11	218	9.91	
11	30	1169	45.20	216	9.82	
12	45	1147	45.20	264	12 00	
13	3 00	1133	42.60	166	7.54	
14	15	1166	44.30	265	12.04	
15	30	1139	44.30	227	10.31	
16	45	1140	42.60	222	10.09	
17	4 00	1162	43.62	221	10.05	
18	15	1154	44.66	215	9.77	
19	30	1154	44.30	220	10.00	
20	45	1154	44.30	241	10.95	
21	5 00	1107	44.30	217	9.86	
22	15	1154	44.30	237	10.77	
23	30	1154	43.45	228	10.36	
24	45	1154	43.79	244	11.09	
25	6 00	1154	43.79	243	11.05	
26	15	1147	43.79	230	10.46	
27	30	1154	43.79	240	10.91	
28	45	933	....	186	8.45	

SEPTEMBER 22, 1880.



OFFICIAL RUN

OF THE

SIMS ELECTRIC (FISH) TORPEDO,

Made at Willet's Point, N. Y. H., on September 24, 1880.

THE RUN was made and the records taken by eleven officers of the Battalion of Engineers, assisted by four non-commissioned officers and twelve privates.

STATIONS established at 15 seconds apart by chronometer, and triangulation at distant station regulated through telephone.

TRIANGULATIONS made by four officers at each theodolite (base-line 1255.8 feet)—one following the fish with telescope, two reading the verniers, and one recording.

STRENGTH OF ELECTRICAL CURRENT determined by an Obach galvanometer, read by an officer.

REVOLUTIONS OF DYNAMO MACHINE automatically recorded on chronograph.

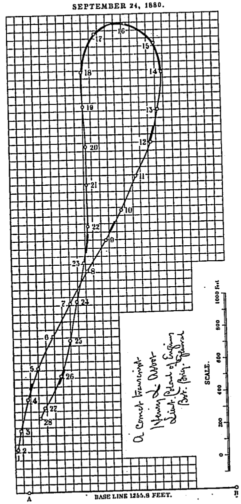
TIMES OF STEERING electrically recorded on chronograph by an officer—shown by the heavy lines on the plot of the run.

FISH TORPEDO piloted by an officer and steered by the inventor.

DETAILS OF THE RUN.

Station	Time after starting	Dynamo Machine (Weston No. 5). Revolutions per minute.	Dynamo Machine (Weston No. 5). Current.	Distance between stations.	Speed per hour.	REMARKS.
No.	m. s.	Rate.	webers.	feet.	miles.	The dynamo machine began to revolve at 10", and was stopped at 6' and 33" after the order was given for starting (station 1). The run developed a fault, exposing bare copper near the middle of the cable. Between stations 3 and 27, a distance of 5441 feet, the fish moved at an average rate of 10.3 miles per hour—the dynamo machine making 1153 revolutions per minute. The total number of revolutions of the screw propeller (pattern C) was 5055; the total distance traveled was 5645 feet (over a mile).
1	0 00	0	0	0	0	
2	15	....	16.95	10	0.45	
3	30	800	18.29	118	5.36	
4	45	1062	28.55	194	8.82	
5	1 00	1125	34.07	204	9.27	
6	15	1169	36.63	214	9.73	
7	30	1169	36.91	226	10.28	
8	45	1177	36.91	226	10.28	
9	2 00	1169	36.91	226	10.28	
10	15	1169	36.63	210	9.54	
11	30	1169	38.02	228	10.36	
12	45	1169	38.02	236	10.68	
13	3 00	1177	37.33	210	9.54	
14	15	1169	37.33	234	10.64	
15	30	1177	36.63	192	8.73	
16	45	1177	36.63	220	10.00	
17	4 00	1136	36.63	220	10.00	
18	15	1162	36.63	256	11.63	
19	30	1169	36.63	220	10.00	
20	45	1185	36.63	249	11.32	
21	5 00	1169	36.91	236	10.73	
22	15	1177	36.91	260	11.82	
23	30	1147	36.63	232	10.54	
24	45	1162	36.63	244	11.09	
25	6 00	1154	36.63	246	11.18	
26	15	1124	36.63	230	10.46	
27	30	1171	35.98	228	10.36	
28	45	....	0	76	3.45	

SEPTEMBER 24, 1880.



OFFICIAL RUN

OF THE

SIMS' ELECTRIC (FISH) TORPEDO,

Made at Willet's Point, N. Y. H., on October 28, 1880.

THE RUN was made and the records taken by ten officers of the Battalion of Engineers, assisted by four non-commissioned officers and twelve privates.

STATIONS established at 15 seconds apart by chronometer, and triangulation at distant station regulated through telephone.

TRIANGULATIONS made by four officers at each theodolite (base-line 1255.8 feet)—one following the fish with telescope, two reading the verniers, and one recording.

STRENGTH OF ELECTRICAL CURRENT determined by an Obach galvanometer, read by an officer.

REVOLUTIONS OF DYNAMO MACHINE automatically recorded on chronograph.

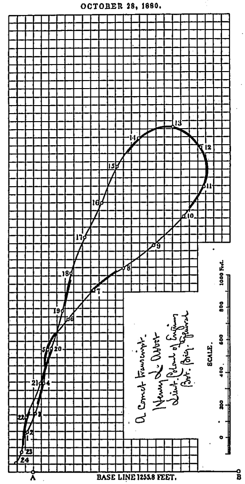
TIMES OF STEERING electrically recorded on chronograph by an officer—shown by the heavy lines on the plot of the run.

FISH-TORPEDO piloted by an officer and steered by the inventor.

DETAILS OF THE RUN.

Station	Time after starting	Dynamo Machine. (Weston No. 5). Revolutions per minute.	Dynamo Machine. (Weston No. 5). Current.	Distance between stations.	Speed per hour.	REMARKS.
No.	m. s.	Rate.	webers.	feet.	miles.	The unusual strength of electrical current shown in this run was not due to any fault in the cable. The speed did not equal that promised by the half runs of September 28 and October 21, 1880, with the same propeller (pattern D). Possibly both anomalies were caused by some escape in the fish itself before the motor was traversed by the current; although none could be detected by inspection after the fish was opened. The internal connections had been slightly modified prior to the run. The dynamo machine began to revolve at about 10 seconds, and was stopped at 5′ and 31″ after the order was given for starting (station 1). Between stations 5 and 23, a distance of 4114 feet, the fish moved at an average rate of 10.4 miles per hour—the dynamo machine making 1174 revolutions per minute. The total number of revolutions of the screw propeller (pattern D) was 3860, the total distance traveled being 4782 feet.
1	0 00	0	0	0	0	
2	15	325	18 64	24	1.09	
3	30	928	34.07	126	5.72	
4	45	1072	52.26	192	8.68	
5	1 00	1127	48.02	206	9.36	
6	15	1201	53.46	222	10.08	
7	30	1217	50.06	232	10.54	
8	45	1217	50.06	224	10.18	
9	2 00	1192	48.02	236	10.68	
10	15	1185	48.02	248	11.28	
11	30	1170	48.02	224	10.18	
12	45	1177	48.02	246	11.10	
13	3 00	1184	48.02	224	10.18	
14	15	1184	48.02	224	10.18	
15	30	1155	45.20	224	10.18	
16	45	1162	46.11	240	10.90	
17	4 00	1189	46.11	224	10.18	
18	15	1177	46.11	224	10.18	
19	30	1140	44.30	224	10.18	
20	45	1141	46.11	238	10.80	
21	5 00	1162	42.60	222	10.08	
22	15	1148	42.60	224	10.18	
23	30	1189	42.60	214	9.72	
24	45	....	0	80	3.24	
25	6 00	0	0	40	1 82	

OCTOBER 28, 1880.



9. A Further Crucial Test by U. S. Officers.

In further exemplification of the efficiency of the Sims Torpedo, and in especial to test the indestructibility of its float, the power of the torpedo itself to resist concussion, and its ability to safely withstand artillery fire, two years later than the tests just described, General Abbot subjected it to an additional series of tests, on September 19, October 26 and November 2, 1882, of which the following is his official report:

OFFICIAL TESTS
OF THE
Sims Electric Torpedo

Made at Willet's Point, N. Y. H., by Brev. Brig.-Gen. Henry L. Abbot.

———:o:———

Headquarters, Battalion of Engineers,
Willet's Point, New York,
December 10, 1882.

Mr. W. S. Sims, *New York City.*

Dear Sir: On September 19, 1882, the float of your torpedo, made in 1881, was anchored in front of a 32-pdr. howitzer. It was fired at five times at a range of 370 yards, and eight times at a range of 186 yards, with double-shotted canister charges, each containing ninety-six balls. The accompanying photograph illustrates the severity of the test, [See page 22).

Five large holes were made by this firing. The float was then towed about a mile by a steam-launch at a rate of five miles per hour. On its return it had lost only 150 pounds of its 400 pounds buoyancy, and was perfectly serviceable for use in an attack.

On October 26, 1882, experiments were made to test its power of resisting concussion. The mast of a schooner, 56 feet long, and 17 inches in diameter at the foot and 13 inches at the head, was anchored by two 500-pound anchors—one at each end. Your torpedo was driven against this obstruction twice, once moving at rate of 7.5 miles per hour, and once at 9.1 miles per hour. Neither shock did any damage. The torpedo in both cases dived under the log and continued its course uninjured.

I regard these tests as sufficient to prove that the torpedo is quite safe against any artillery fire which it would encounter in actual service, and that no temporary protection, in the shape of spars or logs moored around a vessel, would be of any value against an attack. Probably a deep iron netting might check its course, but the explosion of its charge—250 pounds of explosive gelatine, or of dynamite—would be sure to open a route for a second torpedo following in wake of the first.

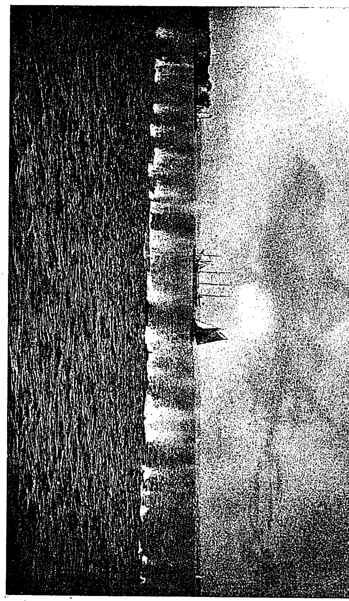
Its steering properties are sufficiently shown by Plate XLIX. of my report to our Board of Engineers.

Very respectfully yours,

HENRY L. ABBOT,
Lieut. Col. of Engineers,
Brvt. Brig-General U. S. A.
Commanding School of Application.

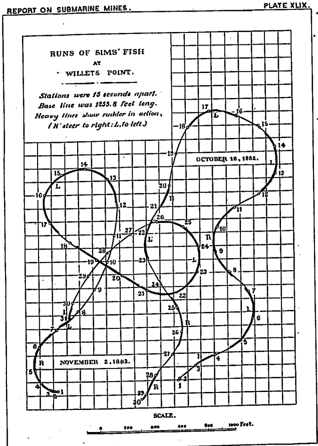
[See opposite page.]

SCHOOL OF SUBMARINE MINING—WILLETS POINT, N. Y. H.



No. 64a. Sept. 19, 1882. The 6th shot at Sims' Fish Torpedo from a 32-pdr. brass howitzer double shotted with canister (96 balls), height of howitzer above water, 35 feet; range, 186 yards; hits, none.

REPORT ON SUBMARINE MINES. PLATE XLIX.



Oct. 18 Speed from Sta. 4 to 28 - a distance of 4960 feet - 9.39 miles per hour
Nov. 2 " " " 5 to 30 - " " 5295 " 9.63 " " "

Official: Henry L. Abbot
Lieut. Col. of Engineers
Bvt. Brig. General U.S.A.
Comdg. Engineer School of Application.

Still other tests of the Sims Torpedo were made at Willet's Point, by Gen. Abbot, on June 16, 1884, the object being to try its steering power and to exhibit the facility with which, at the will of the operator, it could be made to describe a circle, to pursue any desired irregular course, to reverse its course, or to cause it to return to its starting point. These trials fully demonstrated the ease and accuracy with which the torpedo could be made to strike any desired object, and at the same time pass under any obstruction. On the above date Gen. Abbot caused a spar, 57 feet long and 17 inches diameter, to be anchored off Willet's Point, a quarter of a mile from the torpedo station. On the first trial the torpedo struck the spar squarely in the middle, the point aimed at, and then dived under it. The course of the torpedo in this trial is shown in Diagram at p. 23. On the second trial the torpedo struck the spar within eighteen inches of the same spot, after which it passed under the obstruction and continued on its way. Its course on this trial is shown in Diagram at p. 23.

10. OPINIONS OF GENS. M'CLELLAN AND ABBOT.

In this connection the following letters from the late Gen. George B. McClellan and Gen. H. L. Abbot have a public interest:

NEW YORK, November 22, 1882.

To the President of the Sims Electric (Fish) Torpedo Co.:

DEAR SIR—In reply to your inquiry, I take great pleasure in stating that I regard Gen. H. L. Abbot, U. S. Engineer, as the highest authority in this country on the subject of torpedoes. His high ability, scientific acquirements, and long experience in charge of the army torpedo station, pre-eminently qualify him to decide upon the merits of any preferred system. His perfect integrity of character precludes the possibility of his giving any other than a thoroughly honest opinion.

Let me add, that, without pretending to be thoroughly conversant with the subject, I am strongly impressed by the conviction that the Sims' is the best of the movable torpedoes yet invented.

Very truly yours,

(Signed) GEO. B. MCCLELLAN,
Maj.-Gen. U. S. Army.

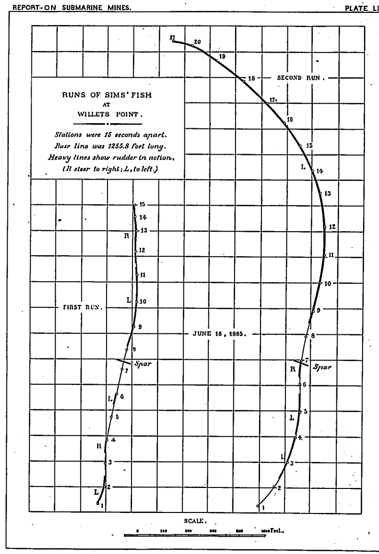
(EXTRACTS FROM LETTER OF DECEMBER 15, 1882.)

The dangerous range of your torpedo. A charge of 250 pounds of dynamite, submerged at the depth requisite to develop its maximum intensity, would disrupt a modern double cellular iron war ship, at a range of 25 feet, a 400-pound charge would do the same at 31 feet, and the effect on the machinery, especially if in action, would be dangerous in the extreme. The explosion at a distance of 50 to 75 feet would not disrupt the hull. The effect on the machinery, if in action, is not so certain. I know of no data which would decide it.

Very respectfully yours,

(Signed) HENRY L. ABBOT,
Lieut. Col. of Engineers, Bvt. Brig.-Gen. U. S. A.,
Com'd'g School of Application.

REPORT ON SUBMARINE MINES. PLATE LIII.



II. Officially Recommended by U. S. A. Officers.

After the above-described trials, runs, and artillery and other tests had demonstrated the energy and efficiency of the Sims Electric Torpedo, the inventor, naturally desirous that his own country should have the first opportunity to avail of its advantages for immediate application to harbor defense, on December 6, 1882, addressed a letter to the Board of U. S. Engineers for Fortifications, at New York, in which he offered to build for the United States Government a "war model" of his invention, on certain prescribed conditions; and on December 14, 1882, the President of the Board, General Z. B. Tower, U. S. A., reported officially to General H. G. Wright, Chief of Engineers, U. S. A., at Washington, the tenor of Mr. Sims' proposal, and the conclusions that had been reached concerning it by the Board of Engineers, of which he was the president, in a letter of which the following is a copy:

OFFICE OF
BOARD OF ENGINEERS FOR FORTIFICATIONS, ETC.,
NEW YORK, Dec. 14, 1882.

Brig.-Gen. H. G. WRIGHT, *Chief of Engineers, U. S. A., Washington, D. C.:*

GENERAL—On behalf of the Board of Engineers I have the honor to enclose herewith a letter from Mr. W. Scott Sims, dated Dec. 6, 1882—in which he proposes to construct a "War Model" of his Electrical Torpedo Boat, arranged to carry 11,000 feet of cable, etc.—and to submit the following remarks thereon:

The experimental Torpedo Boat, made for the Government in 1879–80, was intended for frequent runs and for successive modifications, as trials suggested improvements. For this reason it was constructed with dimensions sufficient only to carry only one mile of cable. * * *

Experiments with this boat have been continued at Willet's Point during the seasons of 1880, 1881 and 1882. They have included—

1st. A study of the new problem of electrical transmission of power.

2d. The determination of the speed attainable with different forms of propellers.

3d. The test of the details of the mechanism—electrical and mechanical—employed in the boat.

4th. Practical trials to determine the efficiency of the protection used against artillery fire.

5th. Practical trials to determine whether the boat possesses the requisite stiffness and strength to resist concussion against a heavy spar when moving at full speed, etc.

The result of this investigation has been to convince the Board that this torpedo should form a part of our system of harbor defense, and that we are prepared to intelligently construct a war-boat carrying two miles of cable. * * *

The Board therefore recommends that this proposition of Mr. Sims be accepted, the funds to be supplied from the appropriation for torpedoes for harbor defense, of which a sufficient amount is available.

Respectfully submitted,

(Signed) Z. B. TOWER,
Col. of Eng'rs and Bvt. Major-Gen., President of the Board.

In accordance with the recommendation of the Board of Engineers, at New York, as reported by General Tower, the proposition of Mr. Sims was accepted, and he furnished the Government a war-boat carrying two miles of electric cable, which was paid for out of an appropriation that had been previously voted for torpedoes for harbor defense.

The next step in the history of the Sims Torpedo was to invite the direct attention of Congress to this important agency for the national defense. Accordingly, on January 26, 1883, the Secretary of the Sims Electric Torpedo Company presented a memorial to the Secretary of War, Hon. Robert T. Lincoln, which, after reciting the recognized advantages of torpedoes, and the thoroughly unprotected condition of American harbors, sea-coast cities, etc., closed as follows:

Your petitioner would therefore respectfully request that you will recommend an appropriation by the present Congress, to be expended by the Board of Engineers, U. S. Army, at its discretion, for the purchase of submarine movable fish-torpedoes, controllable from and propelled by power from shore-stations, of model approved by the said Board of Engineers of the Army of the United States.

By order of the Secretary of War, this petition was, on the same day, referred to the Chief of Engineers of the United States Army, at Washington, and on the day following was by him referred to the Office Board of Engineers for Fortifications, etc., at New York, for report and recommendations at an early day. On January 29, 1883, the last named Board reported, as follows:

OFFICE BOARD OF
ENGINEERS FOR FORTIFICATIONS, ETC.,
NEW YORK, January 29, 1883.

Respectfully returned to the Chief of Engineers.

Our system of sea-coast defense is based:

1st. Upon so obstructing the channels of approach to our great sea-ports and harbors, by stationary mines, operated by electricity, as, while permitting the free passage of our own vessels, to close them against an enemy.

2d. Upon such land batteries and modern rifle ordnance of heavy calibre as shall render it impossible for the hostile fleet to approach and remove the mines.

3d. Upon such controllable fish-torpedoes as shall be able to cope, not only with war vessels of the first-class, but also with special armored boats designed to open a passage through the obstructed channel by countermining, etc.

Fish-torpedoes, therefore, form a recognized part of our system of defense, and in the present incomplete condition of our batteries, and the total lack of heavy rifled ordnance, their importance for us is greatly enhanced.

We are, therefore, of the opinion that a sum of $200,000, or a larger sum, if Congress sees fit to grant it, can be used with great advantage in the construction of controllable fish-torpedoes, unhampered by conditions as to time of disbursements.

Respectfully submitted on behalf of the Board.

(Signed) JOHN NEWTON,
Col. of Eng'rs, Bvt. Maj.-Gen., President of the Board.

The memorial was then returned to the Secretary of War, by the Chief of Engineers, Brig. and Bvt. Major-General A. G. Wright, with the above indorsements, and also with an indorsement inviting the attention of the Secretary to the views expressed by the Board of Engineers, above given, and emphatically adding *in which I concur.* And thereupon the Secretary forwarded the petition, with the indorsements thereon, to the Appropriation Committee of each House of Congress, accompanied by the following letter:

WAR DEPARTMENT,
WASHINGTON, D. C., Feb. 2, 1883.

SIR--I have the honor to invite your attention to the inclosed copy of a communication from Oscar Marshall, and the indorsements thereon of the Board of Engineers, in which it is recommended that an appropriation of $200,000 at least should be made for the construction of controllable fish-torpedoes, unhampered by conditions as to time of disbursement.

I believe that the particular kind of torpedo mentioned in the within communication is considered by engineer officers to possess great excellence; but if Congress should see fit, as I urgently recommend, to make an appropriation for this general purpose, I would prefer that the department be not restricted by the form of the appropriation to any particular kind of torpedo, so that if a better one should be found before the disbursement of the appropriation, it could be adopted.

Of the great necessity for adequate provision for defense of this character I think there can be no doubt.

Very respectfully, your obedient servant
(Signed) ROBT. T. LINCOLN,
Secretary of War.

To
Hon. WM. B. ALLISON,
Chairman Com. on Appropriation,
U. S. Senate.

Since the presentation of the above petition and its reference by the Secretary of War to the Appropriation Committees of Congress, that body has appropriated $187,500 to the purchase and construction of Sims' Torpedoes, and in conformity therewith, eight torpedoes have been contracted for by the Government, making a total of ten, that up to this date (January 1, 1886) have been contracted for by the U. S. Government and have either been furnishep or are in process of construction.

12. THE SIMS-EDISON TORPEDO COMPANY.

The Sims-Edison Torpedo Company of New York, which is the owner of the important invention that has been described in the foregoing pages, has secured patents for the invention from every European and American Government, and is now prepared to negotiate for the sale of its torpedo or for certain of its patent rights. The latest improved machinery which the company has made or is now making, to fill orders received from the U. S. Government, has established the fact that the speed of the Sims-Edison Torpedo will be materially increased and will probably reach several miles an hour in excess of its best records in the past.

The company is now prepared to receive and fill orders, and to make contracts to manufacture and supply the Sims-Edison Electric Torpedo Boats complete, of the most approved pattern, with the latest improvements and best electrical apparatus, and capable of running one, two or more miles.

It has made contracts with the Edison Machine Works of New York (the largest shop in the world for the manufacture of electrical machinery), and with the Armington & Sims Engine Company of Providence, R. I. (also the largest shop in the world for the manufactnre of the special class of engine which the electrical machinery requires), and with other large firms for the manufacture of boilers, etc., that enable it to insure to its customers the lowest price for the particular machinery to fully equip the shore end of the system.

Estimates will be given for stations for running any number of boats at any one time, also for the supply of war materials, electrical machinery, cables, etc., etc.

United Telephone Company, Ltd.

This folder contains printed material issued by the United Telephone Company, Ltd. Organized in London in 1880, this company brought together the patents of Edison and Bell through the merger of their respective London telephone companies -- the Edison Telephone Company of London, Ltd. and the Telephone Company, Ltd.

The following item has been filmed: "General Information for Subscribers . . ." (1880).

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BELL'S and EDISON'S PATENTS.

London Exchange Stations.

36, Coleman Street, E.C.; 77, Cornhill, E.C.; 11, Queen Victoria Street, E.C.; 34, Eastcheap, E.C.; Leadenhall House, Leadenhall Street, E.C.; Lonsdale Chambers, Chancery Lane, E.C.; East India Avenue, E.C.; 3, 4 & 5, Little Windmill Street, W.C.; Palace Chambers, St. Stephen's, Westminster, S.W.; Leather Exchange, Bermondsey, S.E.; Hop Exchange, Southwark Street, S.E.

Provincial Exchanges.

Manchester, Bolton, Liverpool, Glasgow, Birmingham, Sheffield, Oldham, Bristol, Dundee, Edinburgh, Leith, Sunderland, Greenock, Belfast, Dublin, Widnes.

Chairman, JAMES BRAND, Esq.

Deputy-Chairman, The Right Hon. E. P. BOUVERIE.

Directors.

VISCOUNT ANSON.
J. W. BATTEN, Esq.
W. PLEYDELL BOUVERIE, Esq.
G. B. DEWHURST, Esq.
J. S. FORBES, Esq.
COL. GOURAUD.
CAPT. R. H. HOME.
W. CUTHBERT QUILTER, Esq.
CHARLES SCHIFF, Esq.
LIEUT.-COL. C. E. WEBBER, R.E.
Sir P. E. WODEHOUSE, K.C.B., G.C.S.I.

Bankers.

NATIONAL PROVINCIAL BANK OF ENGLAND.
Messrs. ROBARTS, LUBBOCK & Co.

Auditors.

Messrs. QUILTER, BALL & CO., 5, Moorgate Street, E.C.
Messrs. PRICE, WATERHOUSE & Co., 44, Gresham Street, E.C.

Solicitors.

Messrs. ASHURST, MORRIS, CRISP & Co., 6, Old Jewry, E.C.
Messrs. WATERHOUSE & WINTERBOTHAM, 1, New Court, Carey Street.

Secretary.

ARNOLD WHITE, Esq.

Chief Office: 36, COLEMAN STREET, LONDON, E.C.

All Communications to be addressed to the Secretary.

August, 1880.

WATERLOW & SONS LIMITED, PRINTERS, LONDON WALL, LONDON.

LONDON:
WATERLOW AND SONS LIMITED, PRINTERS, LONDON WALL.

THE UNITED TELEPHONE COMPANY,

LIMITED.

(BELL'S & EDISON'S PATENTS.)

This Company is established for the purpose of bringing within the reach of the public the use of the Telephone in all the operations of government, commerce, and daily domestic life, so that conversation can be carried on between two persons at any distance apart, without the intervention of a third person.

The entire success of the system of Telephone Exchanges, by which all persons wishing to communicate orally with one another at a distance are enabled so to do at short notice with perfect secrecy and with the use of the smallest number of communicating wires, obliges the Telephone Company to lose no time in establishing Exchanges in all parts of the United Kingdom, wherever a sufficient number of subscribers can be found who are willing to avail themselves of them.

The Company are prepared to take immediate steps to establish an Exchange, wherever twenty subscribers can be found within a circle of two miles diameter, and where no extraordinary difficulties for the erection of wires are encountered.

The subscription will secure to each the use of apparatus suited to the situation, or to the particular requirements of the subscriber. The patents possessed or worked by the Company include the use of the best appliances. One of the advantages of the system is, that, like the water or gas, which are laid on to a dwelling, the Telephone will be fixed, and all the facilities of the newest inventions provided, for an annual rental or subscription, which can be terminated and resumed with reasonable notice.

For domestic purposes Exchanges can be connected with cab-stands, telegraph-offices, police-stations, fire-stations, shops, &c.

In order that Telephones for exclusive private use, between house and house, may be within the reach of the public at the lowest cost compatible with good maintenance, the Telephone Company will provide and maintain speaking-apparatus within a radius of one mile of all their Exchanges at a low annual rental, with a slight increase for each additional mile of such radius.

This increased charge will be reduced whenever new Exchanges are opened at a diminished mileage distance.

The principle the Telephone Company propose to adopt in the extension of their system, is, to attract the sympathies, interest, and co-operation of the public in each locality where their appliances are used, and to enlist the assistance of local influence in the management.

Under the headings (see page 6) "Subscriptions to Exchanges," "Rentals of Private Stations," "Rentals of Private Lines for Telephones," is described the manner in which the Company propose to charge the public. The first refers to those stations which are connected with Exchange centres, by which the subscriber can converse with all other stations connected with the same centre. Under the second and third are scales of charges for Private Lines, framed to extend to the public the use of the Telephone at a minimum cost.

The Company, in restricting their operations to the letting of apparatus within the United Kingdom, will secure to their customers the advantage of the use of the newest and best forms of apparatus, and further, save them all trouble as to the setting up, the maintenance, and the removal of the same.

SUBSCRIPTIONS TO EXCHANGES.

Each annual subscription for a *Station*, in connection with a Telephone Exchange, is £20, within a radius of one mile from the exchange; the subscription, beyond that distance, to be the subject of special agreement in each case.

At this charge, each subscriber will be provided with the following apparatus, and one such set constitutes a *Station*:—

1 Transmitting Telephone.
1 Receiving Telephone.
1 Bell and push, or other means of calling. } Separately or combined.
1 Battery (if necessary).

Any reasonable additions or alterations to the above, rendered necessary for efficiency of hearing, by the abnormal condition of locality or by the physical necessities of the subscriber, will be made without altering the subscription.

Additional apparatus, within the *Station* and on the same line, above those required to establish the station, will be charged for at additional rentals, similar to those published on page 6 for private lines.

Additional Stations on the same line, or on separate lines, communicating with the same exchange, will be charged, to the same subscriber for his bonâ fide use, at reduced rates, to be agreed on in each case.

Special arrangements will be entered into, when it is desired that one station should be made to serve two or more subscribers who are neighbours. In special cases the Company will not object to placing two subscribers on the same wire, at a reduction of rental to each of 25 per cent.

Subscribers will be required to pay for the cost of alterations.

For domestic purposes Exchanges can be connected with cab-stands, telegraph-offices, police-stations, fire-stations, shops, &c.

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1 Transmitting Telephone.	Separately
1 Receiving Telephone.	or
1 Bell and push, or other means of calling.	combined.
1 Battery (if necessary).	

Any reasonable additions or alterations to the above, rendered necessary for efficiency of hearing, by the abnormal condition of locality or by the physical necessities of the subscriber, will be made without altering the subscription.

Additional apparatus, within the *Station* and on the same line, above those required to establish the station, will be charged for at additional rentals, similar to those published on page 6 for private lines.

Additional Stations on the same line, or on separate lines, communicating with the same exchange, will be charged, to the same subscriber for his bonâ fide use, at reduced rates, to be agreed on in each case.

Special arrangements will be entered into, when it is desired that one station should be made to serve two or more subscribers who are neighbours. In special cases the Company will not object to placing two subscribers on the same wire, at a reduction of rental to each of 25 per cent.

Subscribers will be required to pay for the cost of alterations.

RENTALS OF PRIVATE STATIONS.

The annual rental for private Stations is calculated on the actual cost of maintenance, and as this will depend on the distance of the Station from an Exchange Centre,

The charge will be :—

At or within a radius of one mile from an Exchange ... £3
For each additional mile ... ... 10 per cent. in addition.

For this charge will be provided the same set of apparatus as constitutes an Exchange Station.

For separate additional parts of the apparatus the charge will be at proportionate rates.

When a large number of stations are rented by one person or corporation, for their own purposes, a percentage will be taken off the above rates, which will be agreed on in each case.

The private Stations will require the use of private lines, for which the annual charge will be :—

In Town, at or within a radius of one mile of an Exchange.

	Miles. ¼	½	1 mile.
Overground	£2.	£3. 10s.	£6.

Lines beyond the above radius, lines on special poles, or lines presenting special construction or wayleave difficulty, to be subject to special agreements for rentals.

An agreement must be signed, in all cases, before extensions are commenced, and a deposit equal to half a quarter of the rental, be paid at the same time, which will be returned when the subscription or rental ceases.

Each agreement will provide for a minimum duration of rental of instruments or station apparatus for one year, and of that for lines for three years.

The Company reserves to itself the right to decline undertaking any Telephone Lines for which they may receive application.

All rentals to commence from the quarter or half-quarter day following the opening of the line or station, and they will be payable half-yearly thenceforward, on the 30th June and 31st December in each year.

Merchants, solicitors, bankers, managers of companies, and others acquainted with the ramifications of large business operations are aware that the Telephone does not enable them to dispense on all occasions with the necessity for personal conference. Much correspondence, and many telegrams and messages, however, become needless when the opportunity of oral communication is ever at hand.

Insurance Offices, with branches or agencies in various parts of the Metropolis, and Banks, are examples of the class of business in which the capacity for immediate and secret communication increases the capacity for the transaction of affairs.

The experience of the brokers in the metropolitan produce markets since the introduction of the Telephone Exchange system during the past year has demonstrated the fact that business can be done with less friction, and in less time, than was possible previous to the systematic development of telephonic Exchanges.

The union of the Company's system with the Docks already in existence, and the Exchange centres opened or about to be opened, is evidence to the shipping interests that the telephone partakes not so much of the character of a luxury, as of that of an indispensable necessity; and the Company are now perfecting such arrangements as will afford facilities to merchants and shippers for prompt communication between the city and the bonded and other wharves on the river-side, and, if necessary, between the shore and temporary stations on board ships in dock.

In order to suit those engaged in business connected with perishable goods, such as market-garden produce, fish, meat, and general supplies for hotels and other large establishments, the Company are prepared to make arrangements for connecting any two stations in communication all night, if so desired; and, where the necessities of business suggest the arrangement, exchanges will be open until a late hour of the night, or even during the whole twenty-four hours.

Nor are the advantages indicated by the description of the commercial uses of the Exchange centres limited to the metropolitan area. Exchange stations will be opened in the neighbourhood of London and other large towns.

By this means commercial men will have conferred upon them the advantage of oral communications with their offices, as well as

with local centres, shops, &c. Work, which would involve wear, and expensive travel, will be transacted at home. The morning's post may be opened in the city, letters read through the telephone, and replies dictated in the same manner, thus effecting a saving of valuable time, and improving the conditions of life necessarily imposed on a man of business.

Even in the case of those who are not much engaged in affairs, or who from physical or other causes are confined to the house, the telephone by economising time creates the opportunity for repose. It is needless to dwell on the value to the heads of families of the power of oral communication with the medical man, with tradesmen, or with co-operative stores; and it is equally needless to enlarge on the manifold services which the telephone is able to render to other classes of the community.

The benefit conferred by the power of immediate access to distant correspondents cannot be said to be purchased dearly at a cost little exceeding a shilling a day.

LIST OF SUBSCRIBERS TO EXCHANGE SYSTEM.

A

Abbott, Wm.	10, Tokenhouse-yard
Abrahams, Mark	117 & 118, Leadenhall-street
Adam, John & James, & Co.	11, Pudding-lane
Adams, William, & Co.	26, Bishopsgate-street
Adamson, Gilfillan & Co.	2, Billiter-avenue, Billiter-street
Adelaide Marine Insurance Co. ...	2, St. Michael's House, Cornhill
Advertisers' Association, Limited ...	57, St. Paul's Churchyard
Agelasto, A., & Co.	Southsea House, Threadneedle-street
Agra Bank	35, Nicholas-lane
"Agricoles" Fire Insurance Co. of Paris...	45, 46 & 47, Cornhill
Alexanders & Co.	24, Lombard-street
Alexandra (Newport) Dock Co. ...	60, Gracechurch-street
Allen Bros. & Co.	Albion-place, London-wall
Allen & Hanbury	Plough-court, Lombard-street
Alliance Marine Insurance Co. ...	Capel-court
Allnutt, Jno., & Co.	50, Mark-lane
Alston, Hamilton & Co.	22, Mincing-lane
Alt, W. J.	14, Queen Victoria-street
American Investment Trust Co. (R. B. Rose, Sec.)	3, Throgmorton-avenue
Analysts, Society of Public	79, Gt. Tower-street
Anchor Line of Steamers, The ...	19, Leadenhall-street
Anderson, A., & Co.	30, Throgmorton-street
Anderson, Anderson & Co.	5, Fenchurch-avenue
Anderson Brothers	16, Philpot-lane
Anderson, H. D., & Co.	21, Birchin-lane
Anderson (Joseph) & Son	Hibernia Chambers
Anderson, Weber & Smith	9, Mincing-lane
Andrade, Joseph	49, Barbican
Anglo-Swiss Condensed Milk Co. ...	10, Mark-lane
Anglo-Universal Bank	Coleman-street House

Anning & Cobb	11, Lime-street
Arbuthnot, W. R., & Co.	32, Great St. Helen's
Argenti Bros.	4, Austin Friars
Argles, Rand, Bailey & Co.	85, Gracechurch-street
Armytage, Percy	8, Copthall-buildings
Ashurst, Morris, Crisp & Co.	6, Old Jewry
Atkinson, Geo., & Co.	66, Aldersgate-street
Australian Lloyds	2, St. Michael's House, Cornhill
Australian & New Zealand Underwriters' Association	34, Leadenhall-street

B

Bailey, Daniel	10, Drapers'-gardens
Bailey, Parker & Wellesley	23, Rood-lane
Baillie, J. R.	St. Margaret's House, Victoria-street
Ditto	15, Old Bond-street
Balme, Charles, & Co.	19A, Coleman-street
Baltic, The	Threadneedle-street
Banbury and Cheltenham Direct Railway Company	8, Drapers'-gardens
Barber Bros.	32, Fenchurch-street
Barlee, E. H., & Burgess	9, Finsbury-circus
Barnett Bros.	10, Great St. Helen's
Barnett, W. H., & Co.	28, Threadneedle-street
Bath, Henry, & Sons	Gresham House
Baxters & Co.	5, Victoria-street
Bayley, James A.	120, Cannon-street
Bayley, J. C., & Co.	1, Queen Victoria-street
Beachcroft & Gordon	4, Tokenhouse-yard
Beaton Bros.	2, Great Winchester-street
Bell, Alexander & Co.	37, Seething-lane
Bell, J. T., & Co.	2, Lower Thames-street
Bell, John	118A, Southwark-street
Bellairs, W. G., & Co.	8, Drapers'-gardens
Bennett, Piercy & Co.	20, Tooley-street
Benskin, Thos.	Castle and Falcon Hotel
Beresford & Co.	St. Olave's Wharf, Southwark
Bergheim, J. S., & Co.	18, Laurence Pountney-hill

"Berlin-Cologne" Fire Insurance Company of Berlin	45, 46 & 47, Cornhill
Bevan, Harris & Garrard	117, Bishopsgate-street within
Bevis, Russell & Co.	8A, King William-street
Birch & Archer	8½, Angel-court, Throgmorton-street
Bird, C. E.	4, Change-alley
Birkbeck Bank	Southampton-buildings
Bishop, W. H.	1, Royal Exchange-buildings
Blades, East & Blades	11, Abchurch-lane
Blænavon Iron Co.	86, Cannon-street
Blockey, A., Greig & Co.	75, Old Broad-street
Bolling & Lowe (formerley Wm. Bird & Co.)	2, Laurence Pountney-hill
Boot, A., & Son	24, Old Bailey
Bosanquet, Curtis & Co.	23, Rood-lane
Boundy, W.	Leadenhall House
Boursot, A., & Co.	9, Hart-street, Mark-lane
Boustead, E., & Co.	34, Leadenhall-street
Boutcher, Mortimore & Co.	9, Leather-market, Bermondsey
Bouverie, the Right Hon. E. P.	17, Moorgate-street
Bower, Edward, & Co.	134, Fenchurch-street
Bowles, George	13, West Smithfield
Bowley & Bristow	34, Leadenhall-street
Bowring, Jamieson, & Co.	7, East India-avenue
Bradshaw, John, & Co.	4, Bishopsgate-street Within
Brand, Robert, & Co.	7, Union-court, Old Broad-street
Brandeis, Goldschmidt & Co.	8, Austin Friars
Brassey, Thomas, M.P.	4, Gt. George-street, Westminster
Braun, S. P., & Co.	16, Philpot-lane
Brett, Hy., & Co.	26 & 27, High Holborn
Brightwen & Co.	8, Finch-lane
British Linen Company Bank	41, Lombard-street
Brookes & Faith	25, Mincing-lane
Brook's Wharf	Upper Thames-street
Brown, Bayley & Dixon	1, Queen Victoria-street
Brown, Geo., & Sons	9, Half Moon-passage, Whitechapel
Brown, Walter H., & Co.	54, Leadenhall-street
Brunton, Bourke & Co.	18, Finch-lane
Buchan, Patrick	10, Angel-court
Buckfastleigh, Totnes and South Devon Railway Company	1, Drapers'-gardens
Budgett, James, & Son	18, Laurence Pountney-lane

Buenos Ayres and Ensenada Port Railway Company, Limited	8, Drapers'-gardens
Bulloch, J. & G., & Co.	13, Fenchurch-avenue
Burchell, William	5, Broad Sanctuary, Westminster
Burt, Boulton & Haywood	64, Cannon-street
Burt, F., & Co.	71, Cornhill
Buttery, John, & Co.	17, Trinity-square

C

Cadiot, E. H.	3, East India-avenue
Campbell, Chas. S., & Co. (Limited) ...	47, Mark-lane
Campbell, J. Pictairn, & Co.	26, Great St. Helen's
Campbell, L. A.	7, Jeffrey's-square
Campbell, Shearer & Co.	70, Great Tower-street
Cannon Brewery Co.	160, St. John's-street
Capel, A. J.	4, Royal Exchange-buildings
Capel (Arthur) & Co.	1, Dunster-court, Mincing-lane
Carey & Browne	36, Mincing-lane
Carlisle & Clegg	2, Great St. Thomas Apostle
Ditto	24, Graham-street, City-road
Carr, J., & Sons	14 & 15, Warwick-street
Carr, J. T.	Bedford-park, Turnham-green
Carter, H. & A.	1A, Laurence Pountney-lane
Carvill, Francis, & Son	4, Bishopsgate-street
Cassell, Smith & Co.	80, Fenchurch-street
Castell & Brown	33, Wardour-street
Ditto	Waterloo Station
Cater, J. W., Sons & Co.	39, Lombard-street
Caudery, W., & Co.	151, Fenchurch-street
Causton, Sir Joseph, & Sons	47, Eastcheap
Central News Office	Ludgate-circus
Central Wales and Carmarthen Junction Railway	1, Drapers'-gardens
Chalmers, W. B. & Co.	Dashwood House, New Broad-street
Chandler, Pixley & Co.	15, Coleman-street
Chaplin, J. C.	3, Temple-gardens, Temple

Chubb & Son	128, Queen Victoria-street
Ditto...	57, St. Paul's Churchyard
Church, Arthur H., M.A., F.C.S. ...	79, Great Tower-street
City Carlton Club	St. Swithin's-lane
City Liberal Club	Walbrook
Clark, Ansted & Co.	13A, Philpot-lane
Clark, Charles, & Co.	Windsor Chambers, Great St. Helen's
Clarke, H., & Co.	17, Gracechurch-street
Clarke, Nickolls & Coombs	Hackney Wick, Victoria Park
Clarkson & Co.	20, Billiter-street
Clayton & Aston	4½A, Warnford-court
Clift, Frederick, LL.D.	111, Cheapside
Cohen, A. & E.	47, Basinghall-street
Cohen, J. H. & Co.	30, Great St. Helen's
Cohen, G. & Co.	600, Commercial-road
Coles, E. G. & Co.	10 and 11, Mincing-lane
Colls & Sons	53, Moorgate-street
Colman (Clement) & Co.	Dunster House, Mincing-lane
Colonial Bank	13, Bishopsgate-street within
Colonial Company, The	16, Leadenhall-street
Commercial Marine Assurance Company	2, St. Michael's House, Cornhill
Commercial Sale Rooms	Mincing-lane
Commercial Union Assurance Co. ...	19 & 20, Cornhill
Compagnie Francaise du Télégraphe de Paris à New York	24, Royal Exchange
Cook, James & Co.	40, Mincing-lane
Cook, J. W.	30, Bury-street
Ditto	Orchard-wharf, Blackwall
Corrie & Co.	17, Little Tower-street
Cory Brothers & Co.	3, Fenchurch-avenue
Cory, Lohden & Jackson	6, Crosby-square
Cotesworth & Powell	148, Leadenhall-street
Coubro' & Potter	18, Billiter street
Coubro', Wm.	29, Threadneedle-street
Coulon, Berthoud & Co.	41, Threadneedle-street
Council of the Corporation of Foreign Bondholders, The	17, Moorgate-street
Courtenay, J. & W. J.	251, Tooley-street
Courtenay, J. Irving	7, Great Winchester-st. Buildings
Cow, P. B., Hill & Co...	46, Cheapside
Cowes and Newport Railway Co. ...	8, Drapers'-gardens

Cox, Patterson & Co.	121, Fenchurch-street
Creditors' Association of Wholesale Dealers	6, Arthur-street East
Croll, Col.	Wool Exchange
Crossley & Co....	53, Gracechurch-street
Crown Perfumery Company	97, Cheapside
Crump, W. A., & Son...	10, Philpot-lane
Culliford & Clark	32, Great St. Helen's
Culm Valley Railway	1, Drapers'-gardens
Cumming and Milford...	27, Leadenhall-street
Currie, Donald & Co.	3 & 4, Fenchurch-street
Cutbill, Son, & de Lungo	37, Old Jewry
Czarnikow, C.	29, Mincing-lane

D

Dalton & Young	29, Mincing-lane
Daniel, Thos., & Co.	4, Mincing-lane
Darling & Son	35, Eastcheap
Daunt, W. H.	11, Queen Victoria-street
Davies, W. G., & Co.	57, Gracechurch-street
Dawson, W., & Sons	148, Upper Thames-street
De Bernales & Co.	45, 46 & 47, Cornhill
Dennis & Dennis	101, Leadenhall-street
Dennis, W. F.	101, Leadenhall-street
Denny, T. A., & Co.	Hibernia-chambers
Dent Bros. & Co.	11, Old Broad-street
Dent, Palmer & Co.	11, King's Arms-yard.
Denver and Rio Grande Railway Company	2, Suffolk-lane, Cannon street
De Rin & Mack	118, Bishopsgate-street within
Dewhurst, Geo., & R.	38, New Broad-street
Direct United States Cable Co. ...	34, Throgmorton-street
Dixon, Carter & Co.	9, & 10 High-street, Whitechapel
Dobree, Samuel, & Sons	6, Tokenhouse-yard
Donnison, John, & Son	20, Wormwood-street

Drake, J. V., & Co.	11, Mincing-lane
Drivers & Co.	1, Whitehall
Duncan, James	9, Mincing-lane
Duncan, W. W.	St. Stephen's Chambers, Telegraph-street
Dyster, Nalder & Co.	6, Crosby-square

E

Eastern Agency, Limited	9, Fenchurch-avenue
Eastty and Corderoy	Hibernia Chambers
Eaton, Richard Henry	75, Old Broad-street
Edenborough & Co.	2, Moorgate-street-buildings
Editor of the *Review*	7, New Inn
Edmundson, J., & Co....	19, Great George-street
Edward, G., & Sons	1, Poultry
Edwards & Harris	12, Great Tower-street
Edwards & Sons	24, Fenchurch-street
Elder, A. L.	7, St. Helen's-place
Elias & Co.	20, Great Winchester-street
Ellis & Co.	Royal Exchange-buildings
Ellis, C. C., Munday & Co.	19, St. Swithin's-lane
Engelhardt, F., & Co....	14, Mincing-lane
English Bank of Rio Janeiro	13, St. Helen's-place
Erlanger, Emile & Co.	43, Lothbury
Ernsthausen & Oesterley	21, Mincing-lane
Escombe Bros. & Co.	3, East India-avenue
Evans, J. H.	1, Riches-court, Lime street
Evans, Lescher & Webb	60, Bartholomew-close
Eves, C. W., & Co.	1, Fen-court

F

Falkirk Iron Co.	67, Upper Thames-street
Fanning, W., & Co.	23, Old Broad-street
Fenner & Appleton	77, St. John-street
Findlay, Durham & Brodie	1, Fenchurch-avenue, Lime-street
Finlay, Campbell & Co.	White Lion-court
Finlay, James & Co.	34, Leadenhall-street
Flint, J. H.	112, Fenchurch-street
Ditto	East India Docks
Floersheim, Louis & Co.	4, Bank-buildings, Lothbury
Forbes, Forbes & Co.	9, King William-street
Foreign & Col. Gov. Trust Co. (R. B. Rose, Sec.)	3, Throgmorton-avenue
Forwood Bros. & Co.	60, Gracechurch-street
Fossick, W. G....	86, Cannon-street
Fourdrinier, Hunt & Co.	Ludgate-square
Fowler & Co.	3, Victoria-street, Westminster
Fox, Edwin, & Bousfield	99, Gresham-street
Fraser, J. & L., & Co....	6, Jeffrey's-square, St. Mary Axe
French & Smith	Brabant-court, Philpot-lane
Frey, A., & Co.	8, Black Raven-ct., Seething-lane
Funck, H., & Co.	27, Leadenhall-street

G

Galbraith, Pembroke & Co.	8, Austin Friars
Gardner, J., & Sons	5, New London-street
Garrard & Niemann	Dunster House, Mincing-lane
Gavin, Birt & Co.	27, Leadenhall-street
Ditto	East India Docks
Gedge, Kirby, Millett & Morse ...	1, Old Palace-yard
Gee, Walter	10 & 12, John-street, Adelphi
Gellatly, Hankey, Sewell & Co. ...	109, Leadenhall-street
Ditto	51, Pall Mall
Gerrard & Co.	3, Newman's-court, Cornhill

Gibbs (Antony) & Sons	15, Bishopsgate-street within
Gillespie, A. M., & Co.	23, Crutched Friars
Goad, Rigg & Co.	10, Mark-lane
Goddard, James, & Co.	12, Little Tower-street
Goetze & Asser	91, Great Tower-street
Goldsmid, B. G.	31, Throgmorton-street
Good, Henry, & Sons	12, Moorgate-street
Gordon (Panmure) & Co.	Hatton-court, Threadneedle-street
Gordon, R. & Co.	66, Mark-lane
Goslett, Alfred, & Co....	Cockpit-yard, Bedford-row
Ditto	26, Soho-square
Goundry & Co.	181, Upper Thames-street
Gouraud, G. E.	6, Lombard-street
Ditto	Binswood, Beulah-hill, Upper Norwood
Gracie & Hunter	96, Leadenhall-street
Grahams & Co.	123, Bishopsgate-street within
Grant, Chambers & Co.	37, Fenchurch-street
Gray, Barrow & Co.	23, Pudding-lane
Gray, Dawes & Co.	13, Austin-friars
Great Northern Railway Co.	Farringdon-street Goods Station
Greatorex, Heyrick A.	82, Old Broad-street
Green (Frank) & Co.	193, Upper Thames-street
Green, F., & Co.	13, Fenchurch-avenue
Green & Pitt	Dunster-house, Mincing-lane
Green, Tomkinson & Co.	32, Nicholas-lane
Greenlees Bros.	31, Commercial-street
Gregory & Sons	2, Knightrider-street
Grey, H., Junior	19, Water-lane
Griffin, John, & Son	Dunster-house, Mincing-lane
Griffiths, N., Tate & Co.	7, Fenchurch-street
Grindlay & Co.	55, Parliament-street
Grosvenor Gallery Library (Limd.), The	136, New Bond-street
Guest & Co.	13, King's Arms-yard
Guildhall	E.C.
Gutike, Paul	44, King William-street

H

Hagenbusch & Co.	34, Fenchurch-street
Hale & Son	10, Fenchurch-avenue
Hall & Douglas	22, Commercial Sale Rooms
Hammond & Co.	27, Martin's-lane
Hampton & Sons	8, Pall-mall
Hancock Bros. & Carey	28, Mincing-lane
Harker, J. C.	8, Warnford-court
Harmon, J., & Co.	14, Mincing-lane
Harris & Dixon	81, Gracechurch-street
Harrison, J. & C.	66, Mark-lane
Harvey, Brand & Co....	65, New Broad-street
Harvey & Davids	115, Bishopsgate-street
Harvey, Sydney, & Co.	27, St. Dunstan's-hill
Haycraft & Gilfillan	3, Great Winchester-street
Hayes, E.	Hibernia Wharf
Hayling Railway Co.	8, Drapers'-gardens
Hayn, Roman & Co.	16, Philpot-lane
Hays, Alfred	4, Royal Exchange-buildings
Hay, J., & Co....	11, Leadenhall-street
Hazell, Watson & Viney	6, Kirby-street, Hatton-garden
Hecksher & Pearson	8, Finch-lane
Henderson Bros.	19, Leadenhall-street
Henderson and Liddell	126, Cannon-street
Herbert, E. (Central News)	22, Moorgate-street
Herring, Dewick and Hardy	31, Walbrook
Hewett, Wm., & Co.	7, Arthur Street West
Hewitt, W., & Co.	4, Commercial Sale Rooms, Mincing lane
Heydemann & Co.	22, Harp-lane
Hichens, Harrison & Co.	21, Threadneedle-street
Hicks, Nash & Co.	Pickle Herring Wharf
Hindley, W. H., & Co.	62, Queen-street
Hitchins, T. F., Bedford & Co. ...	16, Rood-lane
Hoare, Wilson & Co.	Dunster-house, Mincing-lane
Hoblyn, Edward	150, Leadenhall-street
Holland, Arthur, & Co.	17, Leadenhall-street
Hollebone Bros. & Trench	2, Royal Exchange Buildings
Hollway Bros.	Jeffreys'-square
Home and Colonial Marine Insurance Co.	8, Royal Exchange
Hop Exchange...	Southwark
Hope, C., & Son	24, Eastcheap

Hore & Tapp	16A, Tokenhouse-yard
Hornby, Hemelryk & Co.	90, Great Tower-street
Horne, F. G.	19, Billiter-street
Horne, H. W.	1, New-square
Horner & Sons	Mitre-square, Aldgate
Horsley, Kibble & Co.	79, Gracechurch-street
Houlder Bros. & Co.	146, Leadenhall-street
Howards & Sons	Plough Court
Ditto	City Mills, Stratford
Huggins, A. E., & Co.	18, Throgmorton-street
Hughes, Chemery & Gold	3, Brabant-court
Hughes, F. A....	44, Mark-lane
Husey, R. A., & Son	Dunster House
Hutchinson, A., & Co.	3 & 4, Great Winchester-street
Huth, F., & Co. (Gen. Offices) / Do. (Coffee Dept.)	12, Tokenhouse-yard
Hyatt, Parker & Co.	4, Moorgate-street-chambers

I

Ichenhäuser, J., & Co.	36, Mark-lane
Ide & Christie	72, Mark-lane
Imperial Insurance Co.	1, Old Broad-street
India-rubber & Gutta-percha Co. ...	106, Cannon-street
Ingall, W. T. F. M., & Sons	Threadneedle-street
Insole, Geo., & Son	147, Leadenhall-street
Institute of Surveyors	12, Great George-street
Isaacs, M., & Sons	60, Fenchurch-street
Isaacs, Moss	151, Cannon-street

J

Jackson & Till... ... ... 24, Commercial Sale Rooms, Mincing-lane
Jacobs, A., & Sons ... ... 8, Russell-street, Covent-garden
James & Shakspeare ... ... 10, Austin-friars
Jimenez, A., & Sons ... ... 65, Fenchurch-street
Johnson, Matthey & Co. ... ... 78, Hatton-garden
Johnstone, H. B. ... ... 10, Dean's-yard, Westminster
Johnston, E., Son & Co. ... ... 6, Great St. Helen's
Jones, R. G., Price & Co. ... ... 1, Church-court, Clement's-lane
Jourdain & Pawle ... ... 6, Warnford-court
Judd & Co. ... ... St. Andrew's-hill, Doctors'-commons
Junior Army and Navy Stores, Limited 15, Regent-street
Junior Carlton Club ... ... Pall-mall
Justice, Philip S. ... ... 14, Southampton-buildings, Chancery-lane

K

Kebble, Son & Co. ... ... Bull Wharf
Keith, Prowse & Co. ... ... 48, Cheapside
Kemble, Trower & Co. ... ... 21, Mincing-lane
Kennard (Stephen) & Co. ... ... 5, Great Winchester-street
Keyser, A. & Co. ... ... 21, Cornhill
Kilkenny Junction Railway ... ... 1, Drapers'-gardens
Kimber, Henry, & Co. ... ... 79, Lombard-street
Kingsbury & Co. ... ... Lombard-house, George-yard
Kino, A. M. ... . 29, Ludgate-hill
Ditto ... ... 46 & 47, Lombard-street
Ditto ... ... 39 & 40, Cornhill
Ditto ... ... 87, Regent-street
Knill, J., & Co. ... ... Fresh Wharf
Knill & Grant... ... ... 30, Pudding-lane
Knowles & Foster ... ... 48, Moorgate-street
Kœbel, Jameson & Co. ... ... 6, Fen-court
Kopf's Extract of Meat Co. (Limited) 2, Drapers'-gardens
Ditto ... ... 28, Hearn-street
Kümpers, Ernst ... ... 1, Fenchurch-avenue
Kuypers, C. ... ... 7, East India-avenue
Kynaston, Edward ... ... 24, Mincing-lane

L

Lake, Beaumont & Lake ... ... 10, New-square, Lincoln's-inn
Lambert Bros.... ... ... 85, Gracechurch-street
Lambert, Charles, & Co. ... ... 1, Crosby-square
Lance, George ... ... 16, Philpot-lane
Land Loan and Enfranchisement Co.... 22, Great George-street
Landau, Hermann ... ... 5, Copthall-court
Lane & Monro ... ... 11, Queen Victoria-street
Langridge, Hy., & Co. ... ... 16, Great St. Helen's
Lanyon & Co. ... ... 29, Gresham House
Lawrence, Frederick Tanner ... ... 36, St. Thomas's-street
Laws, Surtees, & Co. ... ... East India Chambers
Lazarus, Lewis, & Sons ... ... 29, Great St. Helen's
Leask, W. ... ... 14, Eastcheap
Leather Exchange ... ... Bermondsey
Leonard, H. S. ... ... 5, St. Peter's-alley, Cornhill
Leon Bros. ... ... 32, Great St. Helen's
Lepard & Smiths ... ... 29, King-street, Covent-garden
Levick, F., & Co. ... ... George-yard, Lombard-street
Leverson, James ... ... 29, Holborn-viaduct
Lewis & Peat ... ... 6, Mincing-lane
Lewisohn & Co. ... ... Hayne-street, Charterhouse-square
Limerick and Kerry Railway Co. ... 6, Westminster-chambers, Victoria-street
Life Association of Scotland ... ... 5, Lombard-street
Ditto ... ... 48, Pall-mall
Lindegreen, A. ... ... 27, Leadenhall-street
Lion Fire Insurance Company ... 5, Lothbury
Littlejohn, Alexr. ... ... 2, Drapers'-gardens
Liverpool and London and Globe Insurance Company ... ... 7 & 8, Cornhill
Lloyd's... ... ... Royal Exchange
Lloyd & Lloyd... ... ... 4, Cloak-lane
London Assurance Corporation ... 7, Royal Exchange
London Banking Association ... ... 57, Old Broad-street
London, Chatham and Dover Railway Victoria Terminus
London Co-operative Wine Association 10 & 12, John-street, Adelphi
London Financial Association ... 1, Drapers'-gardens

London and St. Katharine Docks Co....	(Col. Martindale), 109, Leadenhall-street
Ditto	(General Office) ditto
Ditto	(Supt.'s Office) London Docks
Ditto	Ditto St. Katharine Docks
Ditto	Ditto Cutler-st. Warehouses
Ditto	Ditto Victoria Docks
London and South Wales Coal Co.,	(Wool Warehouse) London Docks
Limited	9, Gracechurch-street
London Stereoscopic Co.	54, Cheapside
Lord Mayor, The Right Hon. the ...	Guildhall
Ditto	... Mansion House
Luke, A. R., & Co.	184, Fenchurch-street
Lumley, E. & H....	31, St. James'-street
Lyman, H. S.	Beulah-hill, Norwood
Lyons Granary	Upper Thames-street

M

Mackenzie Bros.	82, Mark-lane
Mackintosh, J....	49, St. James-street
Macnaghten & Stapleton	8, Mincing-lane
Macnicoll & Rogers	35, Gresham House
Mactaggart, Tidman & Co.	36, Leadenhall-street
McCall, John, & Co.	137, Houndsditch
McCaul, Gilbert J., & Co.	27, Walbrook
McEwan, Jas., & Co.	27, Lombard-street
McIlwraith, McEacharn & Co. ...	34, Leadenhall-street
Ditto	East India Docks
McIlwraith, R.	8, Fenchurch-avenue
McKenna & Co.	78, Old Broad-street
McNish, Alfred H.	77, Old Broad-street
Maddick, A.	Crown-buildings, Old Broad-street
Major & Field (General Offices) ...	Red Lion Whf. & Three Cranes Whf.
Ditto (Tea Dept.)	Ditto
Malcolm, W. F., & Co.	30, Leadenhall-street
Manbre Saccharine Co., Limited ...	110, Cannon-street
Manning, Collyer & Co.	141, Fenchurch-street
Manning, Wm. Oke, & Son	46, Lower Thames-street
Mansion House	E.C.

Marcus & Co.	59, Mark-lane
Marine Insurance Co.	20, Old Broad-street
Marshall, A.	34, Eastcheap
Marshall & French	14, Mincing-lane
Matheson & Grant	32, Walbrook
Matterson, O'Neil & Co.	Wellington-chambers
Mee, G. Brooke	9A, Great St. Helen's
Megaw & Norton	12, Pancras-lane
Meier, C. G. & Co.	16, Philpot-lane
Melchers, Runge & Co.	1, Fenchurch-avenue
Mendel, Moritz	153, Leadenhall-street
Mercantile Trust Co. of New York ...	6, Lombard-street
Mercer & Mercer	19, Savile-row
Ditto	10, Mark-lane
Merritt & Hatcher	2, Grocers' Hall-court, Poultry
Merton, H. R. & Co.	118, Leadenhall-street
Metal Exchange	4, Lombard-court, Gracechurch-st.
Metropolitan Railway Co. (Secretary)...	32, Westbourne-terrace and London Bridge
Metropolitan Wharf	Wapping-wall
Milburn, W., & Co.	1, Billiter-avenue
Mile End Distillery Co.	86, Mile End-road
Miller & Halls	Hibernia-chambers, London Bridge
Millwall Dock Co.'s Office	1, Railway-place
Moffatt & Co.	28, Fenchurch-street
Moffatt & Heath	38, Mincing-lane
Moon, Bower & Co.	21, Mincing-lane
Moore, Henry R.	Exchange-chambers, Change-alley
Mordaunt Bros.	1A, St. Helen's-place
Morrison, Bruce & Co.	22, Great St. Helen's
Morrison, Thomas	2, Lombard-court
Mosenthal, Julius, & Co.	1, Beer-lane, Great Tower-street
Mosses & Mitchell	51, Gracechurch-street
Mounsey, Jasper C., & Co.	2, Suffolk-lane
Muir, H. B., & Co.	26, Old Broad-street

N

Nathan, D.	21, Threadneedle-street
National Deposit Bank	17, Russell-street, Covent-garden
National Mercantile Bank, Limited	29, Lombard-street.
National Provincial Bank	112, Bishopsgate-street
Naylor, Benzon & Co.	34, Old Broad-street
Nesbitt, Thos., & Co.	3, High-street, Borough
New Zealand Insurance Co.	34, Leadenhall-street
New Zealand Shipping Co.	84, Bishopsgate-street
Nicholls & Clarke	6, High-street, Shoreditch
Nicholson, James, & Co.	214, Upper Thames-street
Nickoll & Knight	21, Great St. Helen's
Nissum Fiord Company, Limited	8, Drapers'-gardens
Northampton and Banbury Junction Railway Company	Ditto
Northern Railway of Buenos Ayres Company, Limited	Ditto
Norton, Rose, Norton, & Brewer	6, Victoria-street, Westminster
Ditto	24, Coleman-street
Ditto	Solicitor's Office, L. B. and S. C. Railway, London Bridge Terminus
Nutter and Pinchin	32, Great St. Helen's

O

O'Beirne, J. L.	Winchester House
Ogilvy, Gillanders & Co.	7, St. Mildred's-court
Ollivier, R. W.	38, Old Bond-street
Oppenheim, J. & S.	21, Throgmorton-street
Oriental Tea Agency	3, Mincing-lane

P

Pacific Mail Steam Ship Co.	Windsor Chambers, Gt. St. Helen's
Padday, H. J. D.	29, Gt. St. Helen's
Palmer, Cecil, & Co.	26, Austin Friars
Paris Underwriting Association	45, 46 & 47, Cornhill
Parker & Co.	St. Michael's Rectory House, Cornhill
Parrish, Dillwyn	2, Copthall-buildings
Patent Chromo. Enamelled Glass Co.	110, Southwark-street
Patry & Pasteur	38, Mincing-lane
Peat, Chattock & Co.	149, Upper Thames-street
Peek (Francis), Winch & Co.	3 & 4, Fenchurch-street
Penfold, J. W.	29, Great George-street, Westminster
Penney, G. H., & Co.	34, Lime-street
Peruvian Guano Co. (Limited)	57, Old Broad-street
Petroleum Association	85, Gracechurch-street
Petroleum Storage Company (Limited)	3, New London-street
Phillips, Ellissen & Co.	39, Throgmorton-street
Phillips & Hill	27, Martin's-lane
Phillips & Webb	6, Great St. Helen's
Pilkington Bros.	171, Queen Victoria-street
Pink (Edward) & Sons	Staple-street, Long-lane
Ditto	48, Eastcheap
Pinkney, Sons & Clare	11, Great St. Helen's
Pittar, Leverson & Co.	50, Gracechurch-street
Pitts, Fr., & Co.	22, Great St. Helen's
Pollock & Co.	63, Lincoln's-inn-fields
Posno, C. J.	19, Finsbury-circus
Potter Bros.	18, Billiter-street
Potter, John, & Co.	15, Great St. Helen's
Ditto	East India Docks
Powell Duffryn Steam Coal Co.	23, Great George-street, Westminster
Power Bros. & Co.	118, Bishopsgate-street within
Prescott, E. G.	11, Warnford-court
Price, C. W.	17, Throgmorton-street
Price, Waterhouse & Co.	44, Gresham-street
Prideaux, W., & Son	Goldsmiths' Hall
Puleston, Brown & Co.	2, Bank-buildings
Pullman European Car Assoc.	57, Old Broad-street
Pullman's Palace Car Co.	St. Pancras Station

Q

Quilter, Ball & Co.	5, Moorgate-street
Quilter, W. Cuthbert	14, King's Arms-yard

R

Railway Debenture Trust Co.... ...	4, Bank-buildings
Ralli Bros.	25, Finsbury-circus
Ralli & Mavrojani	117, Bishopsgate-street within
Ransomes & Rapier	5, Westminster-chambers
Redwood, Boverton	85, Gracechurch-street
Rees, Hy., & Co.	196, Westminster Bridge-road
Reinachs, Nephew & Co.	5, Rood-lane
Reinhold & Co. (Calcutta)	34, Fenchurch-street
Renshaw & Renshaw	2, Suffolk-lane, Cannon-street
Renton Bros. & Co.	16, Throgmorton-street
Reynolds, Sons & Co....	25, Charterhouse-street
Richards, Tweedy & Co.	2, Finch-lane
Richardson, W. W., & G.	3, Lombard-court
Ridpath & Ridpath	33, George-street, Hanover-square
Robinson, Fleming & Co.	21, Austin Friars
Rodman, W. H.	11, Royal Exchange
Rogers, G. F.	5, Great Winchester-street
Rogers, Hy., Sons & Co.	134, Leadenhall-street
Rollins, J. G., & Co.	Old Swan Wharf, Upper Thames-st.
Rolls & Lucock	21, Mincing-lane
Ross, Geo., & Co.	80, Cornhill
Rouse, R. J., & Co.	130, Fenchurch-street
Royal Bank of Scotland	123, Bishopsgate-street
Rugg, C. H., & Co.	82, Bishopsgate-street
Rumney, Howard	18, Walbrook
Rushton Brothers	18, Lime-street
Rustless & General Iron Co.	97, Cannon-street

S

St. Helen's Glass Company	Bridge-chambers, 171, Queen Victoria-street
St. Lucia Central Sugar Factory Company, Limited	8, Drapers'-gardens
Samuel, Montagu & Co.	60, Old Broad-street
Sandeman, G. G., Sons & Co.	20, St. Swithin's-lane
Sanders Brothers	25, Abchurch-lane
Sargant, W. T., & Sons	6, Mincing-lane
Schillizi, T. E....	121, Bishopsgate-street within
Schwann & Co....	6, Moorgate-street
Schwartz, J.	14, Mincing-lane
Schweder & Co.	59, St. Mary Axe
Scott & Co.	8, Idol-lane
Scott, Simpson & Wallis	73, Great Tower-street
Scott, S. R., & Co.	75, Old Broad-street
Scrimgeour, J. & A.	18, Old Broad-street
Scrutton & Campbell	114, Fenchurch-street
Ditto	West India Dock-road
Ditto	Canning Town
Scrutton, Sons & Co.	9, Gracechurch-street
Scrutton & Son	81, Old Broad-street
Searight, James, & Co.	7, East India-avenue
Sechiari Bros. & Co.	3, Adam's-court
Shadwell, L. L.	1, New-square
Sharman, Catling & Co.	Southsea House, Threadneedle-street
Sharps & Wilkins	18, Great Winchester-street
Shaw, Finlayson & Co.	88, Bishopsgate-street
Shepard & Co.	25, Mincing-lane
Shepheard & Sons	32, Finsbury-circus
Silva (Bruno) & Son	25, Crutched Friars
Silverston, Mark	4, Warnford-court
Simson Brothers	34, Fenchurch-street
Sinclair, Hamilton & Co.	17, St. Helen's-place
Skinner, Thomas, & Co.	7, East India-avenue
Sloane, Wells & Taylor	24, St. John-street, Smithfield
Smith & Charles	Southsea House
Smith, George, & Co....	114, Fenchurch-street
Smiths & Gore	16, Whitehall-place, Westminster
Smith, Payne & Smiths	1, Lombard-street

Smith, W., & Co.	... 106, Leadenhall-street
Smith, W. M., & Son	... Smith's Wharf, Queenhithe
Smith, Wood & Co.	... 14, Leadenhall-street
Soares, A. J.	... 11, St. Benet's-place
Society of Arts	... Adelphi
Southwell, A. C.	... 53, King William-street
Spalding & Hodge	... 147, Drury-lane
Spencer, James E. & Samuel ...	... 97, Cannon-street
Spicer Brothers	... 19, New Bridge-street
Spicer, James, & Sons ...	... 50, Upper Thames-street
Stafford & Uttoxeter Railway...	... 1, Drapers'-gardens
Stanes, Watson & Co.	... 4, Cullum-street
Staples, Henry...	... 4, Royal Exchange Avenue
Steel Brothers & Co.	... 6, East India Avenue
Stephens & Reynolds	... 3, Clement's-lane
Stephenson & Co.	... 5, Muscovy-court
Stock and Share Auction Co....	... Crown-buildings, Old Broad-street
Stockdale, E.	... 14, Queen Victoria-street
Stocken, J. A., & Co.	... 74, Old Broad-street
Straker Brothers & Co. ...	... 35, Camomile-street
Straker, S., & Sons	... 124, Fenchurch-street
Strauss, A., & Co.	... 16, Rood-lane
Street, G., & Co.	... 30, Cornhill
Stuart Brothers & Co. ...	... 11, Queen Victoria-street
Stuart, J. M.	... Beulah-hill, Norwood
Stunmore, Weston & Co. ...	... 31, Leadenhall-street

T

Tamvaco & Co.	... 5, Fenchurch-street
Tapp, A. M.	... 4, Great George-street
Tatham & Co.	... 35, Pudding-lane
Taylor, Bethell & Roberts ...	... 110, Fenchurch-street
Ditto	... East India Docks
Taylor (Wm.) & Dottridge ...	... 18, Duke-street, London Bridge
Taylor & Son	... 4, Field-court, Gray's-inn
Temple, The	... London
Terrell & Honey	... 70A, Aldermanbury

Theobald, J. Wilson	... 8, Drapers'-gardens
Theodor & Rawlins	... 10, Mincing-lane
Thompson, W. James & Henry	... 38, Mincing-lane
Thomson, Wm. S., & Co. ...	... 97, Cheapside
Thorburn, Thomas, & Co. ...	... 21, Mincing-lane
Thornhill, Cecil	... 2, Warnford-court
Thornhill, W., & Co.	... 144, New Bond-street
Do. Workshop No. 1 ...	... Eden Works, Euston-road
Do. Do. No. 2 ...	... Oxford-street
Do. Do. No. 3 ...	... Little Windmill-street
Do. Do. No. 4 ...	... Great Marlborough-street
Do. Do. No. 5 ...	... John-street, Bedford-row
Do. Do. No. 6 ...	... Ave Maria-lane
Tolmé and Runge	... 11 and 12, Great Tower-street
Townend, Alexr.	... Dunster House, Mincing-lane
Tramways & General Works Co.	... 57, Moorgate-street
Travers (Joseph) & Sons ...	... 119, Cannon-street
Truscott, James, & Son ...	... Suffolk-lane
Tudor, Moore & Co.	... 27, Leadenhall-street
Turnbull, Alexander, & Co. ...	... 25, Lime-street
Turner, Brightman & Co. ...	... 15, Great St. Helen's
Tyers, Thompson & Co. ...	... 29, Mincing-lane
Tylor & Mann	... 5, East India Avenue

U

Union S. S. Co.	... 11, Leadenhall-street
United Telephone Co. (Limited)	...
Secretary	... 36, Coleman-street
General Offices... ...	... Ditto
Metropolitan Manager	... 11, Queen Victoria-street
Engineer	... 10, Old Jewry Chambers
Unwin Bros.	... 109A, Cannon-street

V

Vigers, F. & R. & A. ...	4, Frederick's-place, Old Jewry
Vivian, Gray & Co.	2, Drapers'-gardens
Vivian, Younger & Bond	117, Leadenhall-street
Von Dadelszen & Co. ...	4, East India-avenue
Von Glehn, R., & Sons	8, Idol-lane

W

Waikato Land Assoc. (Limited)	34, Leadenhall-street
Walker, Howard & Co.	70, Lower Thames-street
Wallis, J. B.	17, Austin Friars
Wallis, J. J.	86, Cannon-street
Waltons, Bubb & Walton	Leadenhall House, Leadenhall-street
Walton, Turner & Walton	15, Lower Whitecross-street
Ward, George ...	1, Bell-yard, Gracechurch-street
Ward, H. S., & Co.	58, Holborn-viaduct
Warner, R.	Brook's-wharf, Upper Thames-street
Warren, Bodle & Co. ...	133 & 134, High-st., Whitechapel
Warrington, John T. ...	25, Tooley-street
Waterhouse & Winterbotham...	1, New-court, Carey-street
Waterlow & Sons Limited	25, Great Winchester-street
Ditto...	49, Parliament-st., Westminster
Watson, Edwd.	108, Bishopsgate-street
Watson, Medill & Co.	29, Mark-lane
Watts, Ward & Co.	85, Gracechurch-street
Webb, Joseph R., & Co	252, Tooley-street
Westcott & Laurance ...	9, Fenchurch-street
West Somerset Railway Company	8, Drapers'-gardens
Whatley & Co....	18, Mincing-lane
White, Binnie & Co. ...	Dunster House, Mincing-lane
White, John ...	26, Great St. Helen's
White, J. B., & Bros....	85, Gracechurch-street
White & Shaxson	8, George-yard, Lombard-street
Whitehall Club	Parliament-street
Wigner, G. W., F.C.S.	79, Great Tower-street

Wild, Thomas, & Co. ...	33, High-street, Borough
Willans, Overbury & Co.	3, Copthall-buildings
Williams, Brown & Elmslie	9, Billiter-square
Willson's Wharf	Southwark
Wilson, Smithett & Co.	41, Mincing-lane
Witherby & Farley	15, Philpot-lane
Witherby & Co.	Newman's-court, Cornhill
Ditto	325, High Holborn
Withers, J.	1, Shorter's-court
Wood, Field & Hanbury	25, Mark-lane
Wool Exchange (Col. A. A. Croll)	Coleman-street
Woodhouse, C. M. & C.	30, Mincing-lane
Woolf & Jacobs	"The Marquis of Granby" Tavern, St. Katherine's Wharf
Woolf, Michael	3, St. James's-place, Aldgate
Woolston & Beeton	6A, Austin Friars
Wright Brothers & Co.	3, Great St. Helen's
Wyman & Sons	74, Great Queen-street
Wynne & Son ...	31, Lincoln's-inn-fields

Y

Yeats, Acocks & Copeman	Hibernia-chambers
Young, J. Russell	46, Fleet-street.

TRADES LIST.

MERCHANTS.

Abrahams, Mark	117, Leadenhall-street
Adamson, Gilfillan & Co.	2, Billiter-avenue
Adams, W., & Co.	26, Bishopsgate-street
Agelasto, A., & Co.	Southsea-house
Allen Bros. & Co.	Albion-place, London-wall
Alston, Hamilton & Co.	22, Mincing-lane
Alt, W. J.	14, Queen Victoria-street
Anderson Brothers	16, Philpot-lane
Andrade, Joseph	49, Barbican
Bayley, James A.	120, Cannon-street
Bayley, J. C., & Co.	1, Queen Victoria-street
Beaton Bros.	2, Great Winchester-street
Bell, John	118A, Southwark-street
Bevis, Russell & Co.	3A, King William-street
Bosanquet, Curtis & Co.	28, Rood-lane
Boustead, E., & Co.	34, Leadenhall-street
Bower, E., & Co.	134, Fenchurch-street
Bowley & Bristow	34, Leadenhall-street
Bradshaw, John, & Co.	4, Bishopsgate-street
Brand, R., & Co.	7, Union-court, Old Broad-street
Braun, S. P., & Co.	16, Philpot-lane
Brown, W. H., & Co.	54, Leadenhall-street
Bulloch, J. & G., & Co.	18, Fenchurch-avenue
Buttery, J., & Co.	17, Trinity-square
Caudery, W., & Co.	151, Fenchurch-street
Campbell, L. A.	7, Jeffrey's-square
Campbell, Shearer & Co.	70, Great Tower-street
Carter, H. & A.	1A, Laurence Pountney-hill
Carvill, Francis, & Son	4, Bishopsgate-street
Cater, J. W., Sons & Co.	39, Lombard-street
Chalmers, W. B., & Co.	Dashwood-house, New Broad-street
Clark, Charles, & Co.	Windsor-chambers, Great St. Helen's
Cohen, A. & E.	47, Basinghall-street
Cotesworth & Powell	148, Leadenhall-street
Coulon, Berthoud & Co.	41, Threadneedle-street
Cutbill, Son & de Lungo	37, Old Jewry
Daniel, Thos., & Co.	4, Mincing-lane

Dent Bros. & Co.	... ...	11, Old Broad-street
Dent, Palmer & Co.	... ...	11, King's Arms-yard
Dewhurst, Geo. & R. ...	...	11, New Broad-street
Dobree, Samuel & Sons	... ...	6, Tokenhouse-yard
Elder, A. L. ...	... ...	7, St. Helen's-place
Elias & Co. ...	... ...	20, Great Winchester-street
Englehardt, F., & Co. ...	... ...	14, Mincing-lane
Ernsthausen & Oesterley	... ...	21, Mincing-lane
Evans, J. H. ...	... ...	1, Riches-court, Lime-street
Eves, C. W., & Co. ...	... ...	1, Fen-court
Fanning, W., & Co. ...	... ...	23, Old Broad-street
Findlay, Durham & Brodie ...	...	1, Fenchurch-avenue
Finlay, Jas., & Co. ...	... ...	34, Leadenhall-street
Finlay, Campbell & Co.	... ...	White Lion-court, Cornhill
Floersheim (Louis) & Co.	... ...	4, Bank-buildings
Forbes, Forbes & Co. ...	... ...	9, King William-street
Forwood Bros....	... ...	60, Gracechurch-street
Fraser, J. & L., & Co.	... ...	6, Jeffrey's-square
Gibbs (Antony) & Sons	... ...	15, Bishopsgate-street
Gillespie, A. M., & Co.	... ...	23, Crutched-friars
Gray, Dawes & Co.	... ...	13, Austin-friars
Grahams & Co. ...	... ...	123, Bishopsgate-street
Harvey, Brand & Co. ...	... ...	65, New Broad-street
Hayn, Roman & Co. ...	... ...	16, Philpot-lane
Heckscher & Pearson ...	... ...	8, Finch-lane
Holland (Arthur) & Co.	... ...	17, Leadenhall-street
Hollway Bros....	... ...	Jeffrey's-square
Horne, F. G. ...	... ...	19, Billiter-square
Horsley, Kibble & Co....	... ...	79, Gracechurch-street
Husey, R. A., & Son ...	... ...	Dunster-house
Huth, Frederick, & Co.	... ...	12, Tokenhouse-yard
Ingall, W. T. F. M., & Sons ...	...	50, Threadneedle-street
Isaacs, M., & Sons ...	... ...	60, Fenchurch-street
Jimenez, A., & Sons ...	... ...	65, Fenchurch-street
Johnston, E., Son & Co.	... ...	6, Great St. Helen's
Kennard (Stephen) & Co.	... ...	5, Great Winchester-street
Knowles & Foster ...	... ...	48, Moorgate-street
Kœbel, Jameson & Co.	... ...	6, Fen-court
Kümpers, Ernst ...	... ...	1, Fenchurch-avenue
Kuypers, C. ...	... ...	7, East India-avenue
Langridge, Henry, & Co.	... ...	16, Great St. Helen's
Lanyon & Co. ...	... ...	29, Gresham-house
Lewisohn & Co.	... ...	Hayne-street, Charterhouse-square
Leon Bros.		32, Great St. Helen's

Mactaggart, Tidman & Co. ...	...	36, Leadenhall-street
McCaul, Gilbert J., & Co.	... ...	27, Walbrook
McEwan, Jas., & Co. ...	... ...	27, Lombard-street
Malcolm, W. F., & Co.	... ...	30, Leadenhall-street
Manning, William Oke, & Son	...	46, Lower Thames-street
Mee, G. Brooke ...	... ...	9A, Great St. Helen's
Megaw & Norton ...	... ...	12, Pancras-lane
Meier, C. G., & Co. ...	... ...	16, Philpot-lane
Melchers, Runge & Co.	... ...	1, Fenchurch-avenue
Mendel, Moritz ...	... ...	158, Leadenhall-street
Merton, H. R., & Co. ...	... ...	118, Leadenhall-street
Mosenthal (Julius) & Co.	... ...	1, Beer-lane, Great Tower-street
Muir, H. B., & Co. ...	... ...	26, Old Broad-street
Naylor, Benzon & Co. ...	... ...	34, Old Broad-street
O'Beirne, J. L. ...	... ...	Winchester-house
Ogilvy, Gillanders & Co.	... ...	7, St. Mildred's-court
Padday, H. J. D. ...	... ...	29, Great St. Helen's
Penney, G. H., & Co. ...	... ...	34, Lime-street
Power Bros. & Co. ...	... ...	118, Bishopsgate-street
Puleston, Brown & Co.	... ...	2, Bank-buildings
Ralli Bros.	... ...	25, Finsbury-circus
Ralli & Mavrojani ...	... ...	117, Bishopsgate-street
Richards, Tweedy & Co.	... ...	2, Finch-lane
Robinson, Fleming & Co.	... ...	21, Austin-friars
Rogers, G. F. ...	... ...	5, Great Winchester-street
Rollins, J. G., & Co. ...	... ...	Old Swan-wharf, Upper Thames-st.
Rushton Bros. ...	... ...	18, Lime-street
Sandeman, G. G., Sons & Co.	...	20, St. Swithin's-lane
Sanders Bros. ...	... ...	25, Abchurch-lane
Schwann & Co....	... ...	6, Moorgate-street
Scott & Co. ...	... ...	8, Idol-lane
Searight, James, & Co.	...	7, East India-avenue
Sechiari Bros. & Co. ...	... ...	3, Adam's-court
Shaw, Finlayson & Co.	... ...	88, Bishopsgate-street
Silva (Bruno) & Son ...	... ...	85, Crutched-friars
Simson Bros. ...	... ...	34, Fenchurch-street
Sinclair, Hamilton & Co.	... ...	17, St. Helen's-place
Smith, Geo., & Co. ...	... ...	114, Fenchurch-street
Smith, Wood & Co. ...	... ...	14, Leadenhall-street
Stanes, Watson & Co. ...	... ...	4, Cullum-street
Steel Bros. & Co. ...	... ...	6, East India-avenue
Strauss, A., & Co. ...	... ...	16, Rood-lane
Tamvaco & Co. ...	... ...	5, Fenchurch-street
Tolme & Runge ...	... ...	11 & 12, Great Tower-street

Tudor, Moore & Co.	27, Leadenhall-street
Turnbull, Alexander & Co.	25, Lime-street
Von Glehn, R., & Sons	8, Idol-lane
Ward, H. & S., & Co.	58, Holborn-viaduct

PRODUCE BROKERS.

Adam, J. & J., & Co.	11, Pudding-lane
Arbuthnot, W. R., & Co.	32, Great St. Helen's
Bailey, Parker & Wellesley	23, Rood-lane
Barber Bros.	32, Fenchurch-street
Bevan, Harris & Garrard	117, Bishopsgate-street
Brookes & Faith	25, Mincing-lane
Carey & Browne	36, Mincing-lane
Clark, Ansted & Co.	13A, Philpot-lane
Coles, E. G., & Co.	25, Mincing-lane
Colman (Clement) & Co.	Dunster-house, Mincing-lane
Cook (James) & Co.	40, Mincing-lane
Corrie & Co.	17, Little Tower-street
Cox, Patterson & Co.	121, Fenchurch-street
Czarnikow, C.	29, Mincing-lane
Dalton & Young	29, Mincing-lane
Drake, J. V., & Co.	11, Mincing-lane
Garrard & Niemann	Dunster-house, Mincing-lane
Goetze & Asser	91, Great Tower-street
Grant, Chambers & Co.	37, Fenchurch-street
Green & Pitt	Dunster-house, Mincing-lane
Griffin, John, & Son	Dunster-house, Mincing-lane
Hale & Son	10, Fenchurch-avenue
Harmon, J., & Co.	14, Mincing-lane
Harvey (Sydney) & Co.	27, St. Dunstan's-hill
Hewitt, William, & Co.	4, Commercial Sale-rooms
Hindley, W., & Co.	62, Queen-street
Hornby, Hemelryk & Co.	90, Great Tower-street
Ide & Christie	72, Mark-lane
Jackson & Till	24, Commercial Sale-rooms
Kemble, Trower & Co.	21, Mincing-lane
Knill & Grant	30, Pudding-lane
Kynaston, Edward	24, Mincing-lane
Leask, W.	14, Eastcheap
Lewis & Peat	6, Mincing-lane
Luke, A. R., & Co.	134, Fenchurch-street

Manning, Collyer & Co.	141, Fenchurch-street
Marshall & French	14, Mincing-lane
Moon, Bower & Co.	21, Mincing-lane
Mordaunt Bros.	1A, St. Helen's-place
Patry & Pasteur	38, Mincing-lane
Rolls & Lucock	21, Mincing-lane
Rouse, R. J., & Co.	130, Fenchurch-street
Scott, Simpson & Wallis	73, Great Tower-street
Sharman, Catling & Co.	Southsea-house
Thorburn, Thomas & Co.	21, Mincing-lane
Townend, Alexander	Dunster-house
Watson, Edward	108, Bishopsgate-street
Whatley & Co.	18, Mincing-lane
White, Binnie & Co.	Dunster-house
Wilson, Smithett & Co.	41, Mincing-lane
Witherby & Farley	15, Philpot-lane
Woodhouse, C. M., & Co.	30, Mincing-lane

SHIPOWNERS AND BROKERS.

Anchor Line of Steamers	19, Leadenhall-street
Anderson, Anderson & Co.	5, Fenchurch-street
Barnett Bros.	10, Great St. Helen's
Bowring, Jamieson & Co.	7, East India-avenue
Capel, A. J.	4, Royal Exchange-buildings
Carvill, Francis, & Son	4, Bishopsgate-street
Clarkson & Co.	20, Billiter-street
Cory, Lohden & Jackson	6, Crosby-square
Culliford & Clark	32, Great St. Helen's
Currie (Donald) & Co.	3 & 4, Fenchurch-street
De Rin & Mack	118, Bishopsgate-street Within
Escombe Bros. & Co.	8, East India-avenue
Flint, J. H.	112, Fenchurch-street
Galbraith, Pembroke & Co.	8, Austin-friars
Gavin, Birt & Co.	27, Leadenhall-street
Gellatly, Hankey, Sewell & Co.	109, Leadenhall-street
Gracie & Hunter	96, Leadenhall-street
Green, F., & Co.	13, Fenchurch-avenue
Grey, H., Jun.	19, Water-lane
Griffiths, N., Tate & Co.	7, Fenchurch-street

Harris & Dixon	81, Gracechurch-street
Hay, J., & Co....	11, Leadenhall-street
Henderson Bros.	19, Leadenhall-street
Houlder Bros. & Co.	146, Leadenhall-street
Jones, R. G., Price & Co.	1, Church-court, Clement's-lane
Langridge, Henry, & Co.	16, Great St. Helen's
Laws, Surtees & Co.	East India-chambers
McIlwraith, McEacharn & Co. ...	34, Leadenhall-street
Marshall, Arthur	34, Eastcheap
~~Mercer & Mercer~~	~~10, Mark-lane~~
Milburn, W., & Co.	1, Billiter-avenue
Mosses & Mitchell	54, Gracechurch-street
Pacific Mail Steam Ship Company ...	Great St. Helen's
Pinkney, Sons & Clare...	11, Great St. Helen's
Potter (John) & Co.	15, Great St. Helen's
Rugg, C. H., & Co.	82, Bishopsgate-street
Scrutton, Sons & Co.	9, Gracechurch-street
Skinner, Thomas, & Co.	7, East India-avenue
Smith, W., & Co.	106, Leadenhall-street
Stumore, Weston & Co.	34, Leadenhall-street
Tatham & Co....	35, Pudding-lane
Taylor, Bethell & Roberts	110, Fenchurch-street
Turner, Brightman & Co.	15, Great St. Helen's
Tylor & Mann	5, East India-avenue
Union Steamship Company	11, Leadenhall-street
Walker, Howard & Co.	70, Lower Thames-street
Watts, Ward & Co.	85, Gracechurch-street
Westcott & Laurance	9, Fenchurch-street
White, John	26, Great St. Helen's
Wright Bros. & Co.	3, Great St. Helen's
Potter Bros.	18, Billiter-street

DOCKS COMPANIES AND WHARFINGERS.

Alexandra (Newport) Dock Co. ...	60, Gracechurch-street
Anderson, Weber & Smith	9, Mincing-lane
Bell, J. T., & Co.	2, Lower Thames-street
Beresford & Co.	St. Olave's-wharf

Brook's Wharf...	Upper Thames-street
Cook, J. W.	30, Bury-street
Hall & Douglas	22, Commercial Sale-rooms
Hicks, Nash & Co.	Pickle Herring-wharf
Hoare, Wilson & Co.	Dunster-house, Mincing-lane
Kebble, Son & Co.	Bull-wharf
Knill, J., & Co.	Fresh-wharf
London and St. Kath. Docks Co. ...	109, Leadenhall-street
Ditto	London-docks
Ditto	St. Katherine-docks
Ditto	Cutler-street
Ditto	Victoria-docks
Ditto	Wool-warehouse, London-docks
Major & Field...	Red Lion-wharf
Metropolitan Wharf	Wapping-wall
Millwall Dock Co.'s Office	1, Railway-place
Smith, W. M., & Sons...	Smith's-wharf, Queenhithe
Warner, R.	Brook's-wharf
Williams, Brown & Elmslie	9, Billiter-square
Wilson's Wharf	Southwark

RAILWAY COMPANIES.

Banbury & Cheltenham Direct Railway Co.	8, Drapers'-gardens
Buckfastleigh, Totnes & South Devon Railway Co....	1, Drapers'-gardens
Buenos Ayres & Ensenada Port Railway Co. (Limited)	8, Drapers'-gardens
Central Wales & Carmarthen Junction Railway Co....	1, Drapers'-gardens
Cowes & Newport Railway Co. ...	8, Drapers'-gardens
Culm Valley Railway Co.	1, Drapers'-gardens
Denver & Rio Grande Railway Co. ...	2, Suffolk-lane
Great Northern Railway Co.	Farringdon-street Goods-station
Hayling Railway Co.	8, Drapers'-gardens
Kilkenny Junction Railway Co. ...	1, Drapers'-gardens

Limerick & Kerry Railway Co. ...	6, Westminster-chambers, Victoria-street
London, Chatham & Dover Railway Co.	Victoria-station
Metropolitan Railway Co.	3, Westbourne-terrace
Northampton & Banbury Junction Railway Co.	8, Drapers'-gardens
Northern Railway of Buenos Ayres Co. (Limited)	8, Drapers'-gardens
Stafford & Uttoxeter Railway Co. ...	1, Drapers'-gardens
West Somerset Railway Co.	8, Drapers'-gardens

METAL TRADE.

Bath, Henry, & Sons	Gresham-house
Bergheim, J. S., & Co....	18, Laurence Pountney-hill
Blaenavon Iron Co.	86, Cannon-street
Bolling & Lowe	2, Laurence Pountney-hill
Boundy, W.	Leadenhall-house
Brandeis, Goldschmidt & Co.... ...	8, Austin-friars
Brown, Bayley & Dixon	1, Queen Victoria-street
Cadiot, E. H.	3, East India-avenue
Carter, H. & A.	1A, Laurence Pountney-hill
Campbell, J. Pitcairn, & Co.	26, Great St. Helen's
Cohen, G., & Co.	600, Commercial-road
Crossley & Co....	58, Gracechurch-street
Cumming & Milford	27, Leadenhall-street
Daunt, W. H.	11, Queen Victoria-street
Davies, W. G., & Co.	57, Gracechurch-street
Dennis, W. F.	101, Leadenhall-street
Falkirk Iron Company	67, Upper Thames-street
Fossick, W. G....	86, Cannon-street
French & Smith	Brabant-court, Philpot-lane
Guest & Co.	13, King's Arms-yard
Gutike, Paul	44, King William-street
Hammond & Co.	27, Martin's-lane
Hitchins, T. F., Bedford & Co. ...	16, Rood-lane

Hoblyn, Edward	150, Leadenhall-street
Hughes, Chemery & Gold	3, Brabant-court
Isaacs, Moss	151, Cannon-street
James & Shakespeare	10, Austin-friars
Lambert, Charles & Co.	1, Crosby-square
Lazarus (Lewis) & Sons	29, Great St. Helen's
Levick, F., & Co.	George-yard, Lombard-street
Lindegreen, A....	27, Leadenhall-street
Lloyd & Lloyd...	4, Cloak-lane
Metal Exchange	Lombard-court
Morrison, Thos.	2, Lombard-court
Mounsey, Jasper C., & Co.	2, Suffolk-lane
Peat, Chattock & Co.	149, Upper Thames-street
Phillips & Hill	27, Martin's-lane
Pitts, Fr., & Co.	22, Great St. Helen's
Richardson, W. W. & G.	3, Lombard-court
Rogers, Hy., Sons & Co.	184, Leadenhall-street
Rustless & General Iron Company	87, Cannon-street
Sargant, W. T., & Sons	6, Mincing-lane
Sharps & Wilkins	18, Great Winchester-street
Soares, A. J.	11, St. Benet's-place
Spencer, J. E. & S.	97, Cannon-street
Stephens & Reynolds	3, Clement's-lane
Stuart Brothers & Co.	11, Queen Victoria-street
Vivian, Younger & Bond	117, Leadenhall-street
Von Dadelszen & Co....	4, East India-avenue

COAL TRADE.

Clarke, H., & Co.	17, Gracechurch-street
Cohen, J. H., & Co.	30, Great St. Helen's
Cory Bros. & Co.	3, Fenchurch-avenue
Gordon, R., & Co.	66, Mark-lane
Harris & Dixon	81, Gracechurch-street
Harrison, J. & C.	66, Mark-lane
Insole, Geo. & Son	147, Leadenhall-street
Lambert Bros.	85, Gracechurch-street
London and South Wales Coal Co. ...	9, Gracechurch-street
Powell-Duffryn Steam Coal Co. ...	28, Great George-street, Westminster

TEA TRADE.

Capel (Arthur) & Co.	1, Dunster-court, Mincing-lane
Cassell, Smith & Co.	80, Fenchurch-street
Edwards & Harris	12, Great Tower-street
Edwards & Son	24, Fenchurch-street
Goddard, Jas., & Co.	12, Little Tower-street
Gonndry & Co.	181, Upper Thames-street
Hancock Bros. & Carey	28, Mincing-lane
Hewett, W., & Co.	7, Arthur-street West
Hope, C., & Son	24, Eastcheap
Macnaghten & Stapleton	3, Mincing-lane
Moffatt & Co.	28, Fenchurch-street
Moffatt & Heath	38, Mincing-lane
Oriental Tea Agency	3, Mincing-lane
Peek, Fras., Winch & Co.	3 & 4, Fenchurch-street
Reinachs, Nephew & Co.	5, Rood-lane
Shepard & Co.	25, Mincing-lane
Theodor & Rawlins	10, Mincing-lane
Thompson, W. J. & H.	38, Mincing-lane
Tyers, Thompson & Co.	29, Mincing-lane

PROVISION TRADE.

Anderson (Joseph) & Son	Hibernia-chambers
Bennett, Piercy & Co.	20 Tooley-street
Bowles, George	13, West Smithfield
Brown, Geo., & Sons	9, Half Moon-passage, Whitechapel
Courtenay, J. & W. J.	251, Tooley-street
Denny, T. A., & Co.	Hibernia-chambers
Dixon, Carter & Co.	9 & 10, High-street, Whitechapel
Eastty & Corderoy	Hibernia-chambers
Hayes, E.	Hibernia-wharf
Kopf's Extract of Meat Co. (Limited)	2, Drapers'-gardens
Ditto	28, Hearn-street
McCall, John, & Co.	137, Houndsditch
Matterson, O'Neil & Co.	Wellington-chambers
Miller & Halls	Hibernia-chambers
Nesbitt, Thos., & Co.	3, High-street, Borough
Reynolds, Sons & Co.	25, Charterhouse-street
Sloane, Wells & Taylor	24, St. John's-street, Smithfield
Taylor (Wm.) & Dottridge	13, Duke-street, London-bridge
Warren, Bodle & Co.	193, High-street, Whitechapel
Webb, Joseph R., & Co.	252, Tooley-street
Warrington, J. T.	25, Tooley-street
Yeats, Acocks & Copeman	Hibernia-chambers

WINE AND SPIRIT TRADE.

Allnutt, Jno., & Co.	50, Mark-lane
Boursot, A., & Co.	9, Hart-street, Mark-lane
Brett, Hy., & Co.	26 & 27, High Holborn
Campbell, Charles S., & Co. (Limited)	47, Mark-lane
Gee, Walter	10 & 12, John-street, Adelphi
Greenlees Bros.	31, Commercial-street
London Co-operative Wine Association	10, John-street, Adelphi
Mile End Distillery Co.	86, Mile End-road
~~Potter Bros.~~	~~78, Billiter-street~~

LEATHER TRADE.

Anning & Cobb	11, Lime-street
Boutcher, Mortimore & Co.	9, Leather-market, Bermondsey
Dyster, Nalder & Co.	6, Crosby-square
Goad, Rigg & Co.	10, Mark-lane
Heydemann & Co.	22, Harp-lane
Lawrence, Fredk. Tanner	36, St. Thomas-street
Leather Exchange	Bermondsey
Schweder & Co.	59, St. Mary-axe
Smith & Charles	Southsea-house

OIL TRADE.

Nicholson, Jas., & Co.	214, Upper Thames-street
Nickoll & Knight	21, Great St. Helen's
Nutter & Pinchin	32, Great St. Helen's
Petroleum Association	85, Gracechurch-street
Petroleum Storage Co. (Limited)	3, New London-street
Phillips & Webb	6, Great St. Helen's

CORN TRADE.

Bell, Alexander, & Co.	... ...	37, Seething-lane
Ichenhauser, J., & Co.	... ...	36, Mark-lane
Lyons Granary...	... ...	Upper Thames-street
Marcus & Co. ...	... ...	59, Mark-lane
Stephenson & Co.	... ...	5, Muscovy-court
Watson, Medill & Co....	... ...	29, Mark-lane

HOP TRADE.

Walton, Turner & Walton	... ...	15, Lower Whitecross-street
Wild, Thos., & Co.	... ...	33, High-street, Borough

SUGAR REFINERS.

Duncan, James	... ...	9, Mincing-lane
Manbré Saccharine Company ...	...	110, Cannon street
St. Lucia Central Sugar Factory Co., Limited	... ...	8, Drapers'-gardens
Schwartz, J. ...	... ...	14, Mincing-lane

WHOLESALE GROCERS.

Budgett, Jas., & Son ...	... ...	18, Laurence Pountney-lane
Henderson & Liddell ...	... ...	126, Cannon-street
Travers, J., & Sons ...	... ...	119, Cannon-street

WHOLESALE CONFECTIONERS.

Castell & Brown	... ...	33, Wardour-street
Clarke, Nickolls & Coombs	... ...	Hackney-wick
Pink (Edward) & Sons	... ...	Staple-street, Long-lane

WOOL TRADE.

Balme, Chas., & Co. ...	... ...	19A, Coleman-street
Edenborough & Co. ...	... ...	2, Moorgate-street buildings
Hyatt, Parker & Co. ...	... ...	Moorgate-street chambers
Willans, Overbury & Co.	... ...	3, Copthall-buildings
Wool Exchange	... ...	Coleman-street

WHOLESALE DRUGGISTS.

Allen & Hanbury	... ...	Plough-court, Lombard-street
Atkinson, Geo., & Co....	... ...	66, Aldersgate-street
Evans, Lescher & Webb	... ...	60, Bartholomew-close
Horner & Sons	... ...	Mitre-square, Aldgate
Howards & Sons	... ...	Plough-court
Howards & Sons	... ...	City-mills, Stratford

TIMBER TRADE.

Burt, Boulton & Haywood	... ...	64, Cannon-street
Gardner, J., & Sons ...	... ...	5, New London-street
Scrutton & Campbell ...	... ...	114, Fenchurch-street

BANKERS.

Agra Bank	35, Nicholas-lane
Alexanders & Co.	24, Lombard-street
Anglo-Universal Bank	Coleman-street House
Birkbeck Bank	Southampton-buildings
British Linen Co.'s Bank	41, Lombard-street
Burt, F., & Co.	71, Cornhill
Colonial Bank	13, Bishopsgate-street
English Bank of Rio Janeiro	13, St. Helen's-place
Erlanger (Emile) & Co.	43, Lothbury
Green, Tomkinson & Co.	32, Nicholas-lane
Grindlay & Co.	55, Parliament-street
Keyser, A., & Co.	21, Cornhill
London Banking Association	57, Old Broad-street
National Deposit Bank	17, Russell-street, Covent-garden
National Mercantile Bank	29, Lombard-street
National Provincial Bank	112, Bishopsgate-street
Royal Bank of Scotland	123, Bishopsgate-street
Samuel, Montagu & Co.	60, Old Broad-street
Smith, Payne & Smiths	1, Lombard-street

STOCKBROKERS, &c.

Abbott, Wm.	10, Tokenhouse-yard
Anderson, A., & Co.	30, Throgmorton-street
Argenti Bros.	4, Austin-friars
Armytage, Percy	3, Copthall-buildings
Bailey, Daniel	10, Drapers'-gardens
Barnett, W. H., & Co.	28, Threadneedle-street
Beachcroft & Gordon	4, Tokenhouse-yard
Bellairs, W. G., & Co.	8, Drapers'-gardens
Birch & Archer	8½, Angel-court
Bird, C. E.	4, Change-alley
Bishop, W. H.	1, Royal Exchange-buildings
Brunton, Bourke & Co.	18, Finch-lane
Buchan, Patrick	10, Angel-court
Clayton & Aston	4½A, Warnford-court
Coubro, William	29, Threadneedle-street

Duncan, W. W.	St. Stephen's-chambers, Telegraph-st.
Eaton, R. H.	75, Old Broad-street
Ellis & Co.	Royal Exchange-buildings
Goldsmid, B. G.	31, Throgmorton-street
Gordon (Panmure) & Co.	Hatton-court
Greatorex, Heyrick A.	82, Old Broad-street
Harker, J. C.	8, Warnford-court
Hichens, Harrison & Co.	21, Threadneedle-street
Hollebone Bros. & Trench	2, Royal Exchange-buildings
Hore & Tapp	16A, Tokenhouse-yard
Huggins, A. E., & Co.	18, Throgmorton-street
Jourdain & Pawle	6, Warnford-court
Landau, Hermann	5, Copthall-court
~~Leon Bros.~~	~~30, Great St. Helen's~~
Littlejohn, Alexander	2, Drapers'-gardens
Macnicoll & Rogers	35, Gresham-house
McKenna & Co.	78, Old Broad-street
McNish, Alfred H.	77, Old Broad-street
Nathan, D.	21, Threadneedle-street
Oppenheim, J. & S.	21, Throgmorton-street
Palmer (Cecil) & Co.	26, Austin-friars
Phillips, Ellissen & Co.	39, Throgmorton-street
Prescott, E. G.	11, Warnford-court
Price, C. W.	17, Throgmorton-street
Quilter, W. C.	14, King's Arms-yard
Renton Bros. & Co.	16, Throgmorton-street
Rodman, W. H.	11, Royal Exchange
Ross, George & Co.	80, Cornhill
Scott, S. R. & Co.	75, Old Broad-street
Scrimgeour, J. & A.	18, Old Broad-street
Scrutton & Son	81, Old Broad-street
Silverston, Mark	4, Warnford-court
Staples, Henry	4, Royal Exchange-avenue
Stock & Share Auction Co.	Crown-buildings, Old Broad-street
Stockdale, E.	14, Queen Victoria-street
Stocken, J. A., & Co.	75, Old Broad-street
Thornhill, Cecil	2, Warnford-court
Vivian, Gray & Co.	2, Drapers'-gardens
Wallis, J. B.	17, Austin-friars
Withers, J.	1, Shorter's-court
Woolston & Beeton	6A, Austin-friars

DISCOUNT BROKERS.

Anderson, H. D., & Co.	21, Birchin-lane
Blockey, A., Greig & Co.	75, Old Broad-street
Brightwen & Co.	8, Finch-lane
Gerrard & Co....	3, Newman's-court
White & Shaxson	8, George-yard

INSURANCE COMPANIES AND BROKERS.

Adelaide Marine Assurance Company	2, St. Michael's-house, Cornhill
"Agricoles" Fire Insurance Company of Paris	45, 46, & 47, Cornhill
Alliance Marine Insurance Company...	Capel-court
Australian Lloyds	2, St. Michael's-house, Cornhill
Australian and New Zealand Underwriters' Association...	34, Leadenhall-street
Berlin-Cologne Fire Insurance Company of Berlin	45, 46 & 47, Cornhill
Commercial Marine Insurance Co. ...	2, St. Michael's-house, Cornhill
Commercial Union Assurance Company	19 and 20, Cornhill
De Bernales & Co.	St. Michael's-house, Cornhill
Frey, A., & Co.	8, Black Raven-court
Haycraft & Gilfillan	3, Great Winchester-street
Hay, J., & Co....	11, Leadenhall-street
Home & Colonial Marine Insurance Company	8, Royal Exchange
Imperial Insurance Company... ...	1, Old Broad-street
Jones, R. G., Price & Co.	1, Church-court, Clement's-lane
Life Association of Scotland	5, Lombard-street
Ditto	48, Pall Mall
Lion Fire Insurance Company ...	5, Lothbury
Liverpool & London & Globe Insurance Company	7 & 8, Cornhill

Lloyd's...	Royal Exchange
London Assurance Corporation ..	7, Royal Exchange-buildings
Marine Insurance Company	20, Old Broad-street
New Zealand Insurance Company ...	34, Leadenhall-street
Paris Underwriting Association ...	45, Cornhill
Potter Bros.	18, Billiter-street

SOLICITORS.

Argles, Rand, Bailey & Co.	85, Gracechurch-street
Ashurst, Morris, Crisp & Co.	6, Old Jewry
Barlee, E. H., & Burgess	9, Finsbury-circus
Baxters & Co.	5, Victoria-street, Westminster
Burchells	5, Broad Sanctuary
Clift, Fredk., LL.D.	111, Cheapside
Crump, W. A., & Son...	10, Philpot-lane
Ellis, C. O., Munday & Co.	19, St. Swithin's-lane
Fowler & Co.	3, Victoria-street, Westminster
Gedge, Kirby, Millett & Morse ...	1, Old Palace-yard
Kimber (Henry) & Co.	79, Lombard-street
Lake, Beaumont & Lake	10, New-square
Lane & Monro	11, Queen Victoria-street
Leonard, H. S....	5, St. Peter's-alley
Norton, Rose, Norton & Brewer ...	6, Victoria-street, Westminster
Ditto	24, Coleman-street
Ditto	London Bridge Terminus
Parker & Co.	Rectory House, Cornhill
Pollock & Co....	63, Lincoln's-inn-fields
Prideaux, W., & Son	Goldsmith's Hall
Renshaw & Renshaw	2, Suffolk-lane, Cannon-street
Rumney, Howard	18, Walbrook
Shepheard & Sons	32, Finsbury-circus
Taylor & Son	Field-court, Gray's-inn
Terrell & Honey	70A, Aldermanbury
Waltons, Bubb & Walton	Leadenhall House
Waterhouse & Winterbotham... ...	1, New-court, Carey-street
Wynne & Son	31, Lincoln's-inn-fields
Mercer & Mercer,	10, Mark-lane
Ditto	10, Savile-row

BARRISTERS.

Chaplin, J. C.	3, Temple-gardens
Courtenay, J. Irving	7, Great Winchester-street
Horne, H. W.	1, New-square
Shadwell, L. L.	1, New-square

CLUBS.

City Carlton Club	St. Swithin's-lane
City Liberal Club	Walbrook
Junior Carlton Club	Pall-mall
Whitehall Club	Parliament-street

ENGINEERS, &c.

Brassey, Thos., M.P.	4, Great George-street, Westminster
Croll, Col.	Wool Exchange
Johnson, Matthey & Co.	78, Hatton-garden
Justice, Philip S.	14, Southampton-buildings, Chancery-lane
Mackenzie Bros.	82, Mark-lane
Matheson & Grant	32, Walbrook
Ransomes & Rapier	5, Westminster-chambers
Wallis, J. J.	86, Cannon-street

GLASS TRADE.

Champion, T.	171, Queen Victoria-street
Goslett, A., & Co.	26, Soho-square
Nicholls and Clarke	6, High-street, Shoreditch
Patent Chromo-Enamelled Glass Co....	110, Southwark-street
Pilkington Bros.	171, Queen Victoria-street
St. Helen's Glass Co.	171, Queen Victoria-street

AUCTIONEERS, ESTATE AGENTS, &c.

Drivers & Co.	1, Whitehall
Fox, (Edwin) & Bousfield	99, Gresham-street
Harvey & Davids	115, Bishopsgate-street
Lumley, E. & H.	31, St. James's-street
Smiths & Gore	16, Whitehall-place
Vigers, F. & R. & A.	4, Frederick's-place, Old Jewry

ACCOUNTANTS.

Chandler, Pixley & Co.	15, Coleman-street
Price, Waterhouse & Co.	44, Gresham-street
Quilter, Ball & Co.	5, Moorgate-street

BOX OFFICES.

Hays, Alfred	4, Royal Exchange-buildings
Keith, Prowse & Co.	48, Cheapside
Ollivier, R. W.	38, Old Bond-street

SUBSCRIPTION ROOMS, &c.

Baltic, The	Threadneedle-street
Commercial Sale Rooms	Mincing-lane
Grosvenor Gallery Library (Limited)	136, New Bond-street
Hop Exchange...	Southwark
Lloyd's	Royal Exchange

ATLANTIC CABLE COMPANIES.

Compagnie Française du Télégraphe de Paris à New York	24, Royal Exchange
Direct United States Cable Co. ...	34, Throgmorton-street

COMMISSION AGENTS.

Caudery, W. & Co.	151, Fenchurch-street
Funck, H. & Co.	27, Leadenhall-street
Hagenbusch & Co.	34, Fenchurch-street

DIAMOND MERCHANTS.

Edward, Geo., & Sons	1, Poultry
Leverson, Jas....	29, Holborn Viaduct
Pittar, Leverson & Co.	50, Gracechurch-street
Posno, C. J.	19, Finsbury-circus
Ridpath & Ridpath	33, George-street, Hanover-square

STATIONERS, PRINTERS, &c.

Boot, A. & Son	24, Old Bailey
Blades, East & Blades	11, Abchurch-lane
Causton, Sir J. & Sons	47, Eastcheap
Darling & Son...	35, Eastcheap
Dawson, W. & Sons	148, Upper Thames-street
Donnison, John & Son	20, Wormwood-street
Fenner and Appleton	77, St. John-street
Fourdrinier, Hunt & Co.	Ludgate-square
Good, Henry & Sons	12, Moorgate-street
Hazell, Watson & Viney	6, Kirby-street, Hatton-garden
Herring, Dewick & Hardy	31, Walbrook
Judd & Co.	St. Andrew's-hill, Doctor's-commons
Lepard & Smiths	29, King-street, Covent-garden
Merritt & Hatcher	2, Grocers'-hall-court
Spalding & Hodge	147, Drury-lane
Spicer Bros.	19, New Bridge-street
Spicer (James) & Sons	50, Upper Thames-street
Straker Bros. & Co.	35, Camomile-street
Straker, S. & Sons	124, Fenchurch-street
Truscott, Jas. & Sons	Suffolk-lane
Unwin Bros.	109A, Queen-street, Cheapside
Waterlow & Sons (Limited)	25, Great Winchester-street
Ditto	49, Parliament-street
Witherby & Co.	Newman's-court, Cornhill
Ditto	325, High Holborn
Wyman & Sons	74, Great Queen-street

MISCELLANEOUS.

Advertisers' Association (Limited) ...	57, St. Paul's-churchyard
American Investment Trust Co. (R. B. Rose, Secretary)	3, Throgmorton-avenue
Analysts, Society of Public	79, Great Tower-street

Anglo-Swiss Condensed Milk Co. ...	10, Mark-lane
Baillie, J. R.	St. Margaret's House, Victoria-street, Westminster
Ditto	15, Old Bond-street
Benskin, Thomas	Castle & Falcon Hotel, Aldersgate-st.
Bouverie, The Rt. Hon. E. P. ...	17, Moorgate-street
Cannon Brewery Co.	160, St. John-street
Carlisle & Clegg	2, Great St. Thomas Apostle
Carr, J., & Sons	14 & 15, Warwick-street
Carr, J. T.	Bedford-park
Central News Office	Ludgate-circus
Chubb & Son	128, Queen Victoria-street
Church, Arthur H.	79, Great Tower-street
Colls & Sons	53, Moorgate-street
Colonial Co.	16, Leadenhall-street
Coubro & Potter	18, Billiter-street
Council of the Corporation of Foreign Bondholders...	17, Moorgate-street
Cow, P. B., Hill & Co.	46, Cheapside
Creditors Association of Wholesale Dealers	6, Arthur-street-east
Crown Perfumery Co....	97, Cheapside
Eastern Agency (Limited)	9, Fenchurch-avenue
Editor of the *Review*	7, New Inn
Edmundson, J., & Co.	19, Great George-street
Foreign and Colonial Government Trust Co. (R. B. Rose, Secretary) ...	3, Throgmorton-street
Gray, Barrow & Co.	23, Pudding-lane
Green, (Frank) & Co....	193, Upper Thames-street
Gregory & Sons	2, Knightrider-street
Hampton & Sons	8, Pall-mall-east
Herbert, E. (Central News)	22, Moorgate-street
Hindley, W. H., & Co.	62, Queen-street
Hughes, F. A.	44, Mark-lane
Hutchinson, A., & Co.	4, Great Winchester-street
India-rubber & Gutta-percha Co. ...	106, Cannon-street
Institute of Surveyors	12, Great George-street
Jacobs, A., & Sons	8, Russell-street, Covent-garden
Junior Army and Navy Stores ...	15, Regent-street
Kingsbury & Co.	Lombard House, George-yard
Kino, A. M.	29, Ludgate-hill
Ditto	46, Lombard-street

Kino, A. M.	39, Cornhill
Ditto	87, Regent-street
Lance, George	16, Philpot-lane
Land Loan and Enfranchisement Co.	22, Great George-street
London Financial Association ...	1, Drapers'-gardens
London Stereoscopic Co.	54, Cheapside
Lord Mayor, The Rt. Hon. The ...	Guildhall
Ditto	Mansion House
Mercantile Trust Co. of New York ...	6, Lombard-street
New Zealand Shipping Co.	84, Bishopsgate-street
Nissum Fiord Co.	8, Drapers'-gardens
Parrish, Dillwynn	2, Copthall-buildings
Penfold, J. W.	29, Great George-street
Peruvian Guano Co. (Limited) ...	57, Old Broad-street
Pullman European Car Association ...	57, Old Broad-street
Pullman's Palace Car Co.	St. Pancras Station
Railway Debenture Trust Co. ...	4, Bank-buildings
Redwood, Boverton	85, Gracechurch-street
Society of Arts	Adelphi
Street, Geo., & Co.	30, Cornhill
Thomson, W. S., & Co.	97, Cheapside
Thornhill, W., & Co.	144, New Bond-street
Tramways and General Works Co. ...	57, Moorgate-street
Waikato Land Association (Limited)	34, Leadenhall-street
Ward, George	1, Bell-yard, Gracechurch-street
White, J. B., & Bros....	85, Gracechurch-street
Wigner, G. W., F.C.S.	79, Great Tower-street

MISCELLANEOUS COMPANY RECORDS

Edison Electric Light Company Bulletins

This bound volume contains twenty-two bulletins issued by the Edison Electric Light Company during the period January 1882-April 1884. These bulletins contain brief accounts of the activities of the various Edison light companies and of developments in the electric lighting industry. Included are testimonials from Edison's customers, lists of customers and types of equipment offered for sale, annual reports of the Edison light companies, and reprints of articles from newspapers and journals.

Much of the material concerns the central power stations at Holborn Viaduct (London) and Pearl Street (New York), as well as other central stations and isolated lighting plants in the United States and abroad. The bulletins also contain descriptions of Edison's exhibits at electrical exhibitions in Paris (1881), London (1882), Chicago (1883), and Louisville (1883.) Other items describe accidents caused by gas lighting; offer cost comparisons between electric and gas lighting; and compare the Edison system with competing electric light systems, especially those of Charles Brush and Joseph Swan. There is also information regarding the formation and operation of the the Edison Electric Light Company, the Edison Company for Isolated Lighting, the Edison Electric Illuminating Company of New York, the Western Edison Light Company, and the Edison Electric Light Company, Ltd.

The spine is stamped "The Edison Electric Light Co. First Series Bulletins 1-22 1882-1884." Each of the 22 bulletins is individually paginated. In addition, the entire volume is continuously paginated, beginning with page 49 and ending with page 547.

[Nos. 1 to 5.]

(Confidential, and for the use of the Company's Agents only.)

FIRST BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE.

New York, January 26th, 1882.

THE FIRE QUESTION. We have received a printed copy of the rules for running wires for electric lights adopted by the New York Board of Fire Underwriters, January 12th, 1882. It is said that these rules will be adopted by the National Board of Underwriters and will then be adopted by the various State Boards and City Boards thoroughout the country. That is to say, these rules will be national. They have been prepared after elaborate consultation with ourselves and the other Light companies, and are on the whole as fair as we can expect for the present. The many fires that have occurred from the arc light have somewhat prejudiced insurance people, and we must suffer in consequence until the superiority of our system is established by practice. The presidents of several insurance companies, notably Mr. Edward Atkinson, President of the Boston Manufacturers Mutual Insurance Co., have visited us and made a careful examination of our system. In all such cases we have satisfied parties of the complete success of our system as regards this question of fire. It only remains now for us to wait until other insurance people who visit us may be satisfied from the practical success of our light that there is absolutely no danger from fire.

SANTIAGO, CHILI. We have letters from Mr. Stewart, Santiago, stating that he has with the assistance of Mr. Lawrence, the engineer, installed a Z dynamo in the Variety Theatre in Santiago, and that the plant is giving the highest satisfaction.

RIO DE JANERIO. Mr. McCarty has succeded in successfully installing his plant in the Exhibition at Rio, where it is working satisfactorily. The agents of Messrs. Fabbri & Chauncey in that city, write them as follows, under date of December 24th: "All those who have visited the Exhibition are much pleased with the Edison light. Besides the Emperor, the President of the Council of Ministers, and the Acting Minister of Public Works has seen the light, as well as other important men of the Empire, all of whom have expressed their satisfaction with it."

AMERICAN ELECTRIC LIGHT CO. This new company is now spending a vast amount of money in advertising, and is reported as being about to light up a building in Boston. We have just had a hearing on one interference in the patent office with this company, namely, upon a claim by Boehm that he was the original inventor of a certain feature in a mercury pump used in making incandescent lamps. Testimony has been concluded in that interference and the patent office has decided against Boehm, and in favor of Edison.

The American Company's so-called lamp is made of two parts fitted together like a glass stopper in a bottle. The theory is that when the carbon breaks, the lamp can be sent back to the factory, taken apart, and a new carbon inserted. But these two parts of the lamp, unfortunately, are not interchangeable, and, besides that, they are apt to be broken in being taking apart. Not being interchangeable, the two parts must always be kept together, because the lower part of any one lamp will not work in the upper part of any other lamp. The trouble arising from that, when manufacturing of the lamps is conducted on a large scale, together with the expense of returning the lamp to the factory to be repaired, and the large breakage in getting the two parts apart, make this lamp practically of no value. Most of our friends believe that the American Co. is an opponent from whom we shall have nothing whatever to fear, and from whom we shall hear nothing, when the stock is once unloaded on the public.

new style of socket gives out, either from being too small or from imperfect contact. Also that the joints in fixtures are poorly made. Also that the wood collar between the connecting screw and outside cover of the standard socket shrinks so much that it is constantly dropping out of the sockets. These matters have been brought to the attention of the manufacturer. Improvement is promised. Will our agents please report if futher trouble is experienced? The manufacturer especially desires that whenever there are imperfections, the imperfect goods should be returned to him in order that he may see for himself just where the trouble is. Our agents will therefore please send back through the proper officials all imperfect goods.

B LIGHTS IN LARGE ROOMS. Here is a suggestion from Mr. BORDEN, of Fall River. Some of our agents entertain different views on the same subject. His suggestion is copied merely for the purpose of encouraging discussion on this important topic.

"As you asked for suggestions drawn from the experience of your agents I beg to offer the following. I think it unwise to talk about B lights in a cotton mill, or other large room. People expect more of the electric light than any other means of lighting, and they are always disappointed with B lights. Mr. KILBURN, of the Wamsutta Mill, is taking all his out to-day, and I am sending him A lights to replace them, having ordered Middleton to change enough lights to take them. Certainly, at the Wamsutta Mills last night, four looms were much better lighted by one A lamp, than two looms by one B lamp. Were my eyes to judge, I should cetainly decide 1 A lamp much more effective than 2 Bs. At the Wamsutta Mills we have to compete with good rosin gas, and B lamps are not up to the competition."

PLANT AT THURBER'S. Messrs. H. K. & F. B. THURBER & Co., wholesale grocers, have in their store a long narrow room over seventy feet in length and lighted only by windows at each end. In this room more than fifty clerks do clerical work all day.

The heat from the gas has proved injurious to health, and the gas light has proved injurious to eye sight. This room is now lighted by one of our isolated plants and the injurious effects of gas are entirely removed. Messrs. THURBER say that the plant gives perfect satisfaction, and that, as they express it, "It has come to stay."

PLANT AT THE MERRIMACK MILLS LOWELL, MASS. Mr. SCHROEDER, writing from the Merrimack Mills, Lowell, Mass., February 15th, says "Every thing in connection with the electric light in the Merrimack Mills is in first rate condition, and I can suggest nothing to make it better. We have had no mishap of any kind and there is no occasion for any. The two dynamos do their work equally and require scarcely any care."

EUROPEAN COMPANY. We have understood for some time that the European Company was looking for buildings in the neighborhood of Paris, for the immediate manufacture of Edison light plant. Mr. BATCHELOR writes from Paris under date of January 24th, that property was purchased the previous day (January 23d), and that he was just commencing to fit up the factory for manufacturing purposes. He enclosed a picture of of the factory representing a large three story building, with out-buildings, situated at Ivry, on the banks of the river Seine.

PLANT AT RIO DE JANEIRO. In a letter just received from Mr. McCARTY, Rio de Janeiro, appear the following facts about the isolated plant, running in that city at the National Exhibition of Brazil. Mr. McCARTY reached Rio December 1st. The Exhibition opened December 12th. He was obliged to place the dynamo 260 feet away from the building, and also to run the wires a distant of 830 feet in the bnilding. His most distant lamp

was 1,090 feet from the dynamo. He used a Z dynamo with A lamps, and all gave good light, running 92 lamps. He was ready to light on December 10th, but found that owing to having to use wire of less than standard purity the light did not burn satisfactorily. He added another wire from the dynamo to the main building, and started his lights December 12ih. The Emperor of Brazil and all his family, inspected the light and the dynamo, and expressed themselves greatly pleased Mr. McCARTY exhibited several devices with the lamps such as immersing them under water, aud also setting up a printer's case with type for compositors to test the light.

ISOLATED PLANT AT STRASBURG, GERMANY. The following is a translation of an article appearing in a recent number of the German paper on Architectnre, *Centralblatt de Bauverwaltung*.

Concerning the electric illumination of the Railroad Depot at Strasburg, in Alsace, by the Edison system, the *Centralblatt* of the railroad administration has received the following communication.

"On the 5th inst. the arrangement already mentioned before of electric illumination by the Edison lamp in the Strasburg depot, went into operation, and the result so far has been a decided success. The steadiness and the color of the light surpasses even the most sanguine expectations. Particular interest is excited by the illumination of the refreshment rooms of the 1st and 2nd classes, for which two Siemens differential lamps, of 150 candle power were applied until now. But the latter (the Siemens lamps) gave occasion for frequent complaints on account of the variability of the light, and its annoying spasmodic spurts, and intensive shades. The Edison lamps are attached to two chandeliers with six arms, derived from the former illumination by gas, the arms having been inverted so that the lamps with the flat reflectors extend downward. The effect of the twelve lamps of 16 candle power each, in this hall of 21 metres in length and 8 metres in width, is magnificent, and calls forth the most unreserved approval. The same is to be said of the lamps in the various offices, both as regards their illuminative effect, and the preservation of pure air. The whole arrangement was made without the assistance of the Edison Company solely by the technical resources of the Imperial General

Administration of Railroads, under the lead of the Telegraph Comptroller, Mr. SHULZE, and it is intended, in consequence of the favorable results attained by this method of illumination, to extend it largely. We reserve a more particular description of this new establishment, together with an estimate of its cost, until after the further extention already in hand is completed. In conclusion it should be mentioned that the merit of first having introduced an arrangement of this kind into Germany and beyond, is due to the Imperial General Administration of Railroad."

ATMOSPHERIC CONDITIONS. In a letter received from Mr. W. N. STEWART, in charge of our isolated plant at Santiago, Chili, mention is made of certain atmospheric conditions which are of interest. I quote from Mr. STEWART's letter.

"Santiago is 1,800 feet above the sea, and for five or six months of the year there is no rain and hardly a cloudy day. Thunder and lightning is unknown, but slight shocks of earthquake are felt once in a month or two. These earthquakes sometimes affect the gas mains, which are very carelessly put down. I observe that the remarkable dryness of the air gives rise to some curious electrical manifestations, and that as much as 400 ohms resistance is necessary on the field of my machine to keep the lamps from burning too fast, but when dampness is perceptible in the air, 20 or 30 ohms is ample.

LONDON. The following cable was received, February 10th, from London. It refers to a visit made by the sender of the telegram to Mr. Johnson's plant at the Holborn Viaduct, where one of Edison's central dynamos is being run. The cablegram is as follows:

"I had a very influential party at Holborn Viaduct last night, consisting of Duke of Sutherland, Marquis of Ormonde, Lord George Hamilton, M. P., Major General Sir Arnold Kimball, Major General Sir Henry Green, Captain Shaw, C. B., Chief of London Fire Brigade, Professor Forbes, Sir Charles Bright, Mr. Peter Redpath, of Montreal, and Mr. Fuller, of the direct U. S. Cable Co. The whole party were highly delighted, and expressed their warmest commendations to Mr. Johnson for his able exposition of Mr. Edison's Electric Light System. The Duke wished to know if Mr. Edison was coming over and when. The Crystal Palace exhibition is generally much behind, the Edison department only being in a forward state."

PLACING LAMPS. We are rapidly gaining experience as to the best way to hang lamps. The following letter from Mr. BROOKS, who has charge of putting an Isolated plant in the Arlington Mills, Lawrence, Mass, will in this connection be read with interest.

"To determine the best method of placing the lamps over the dressing frames at the above mills, I started the dynamo with twenty-seven A lamps in the circuit as follows: twenty-four on brackets, two placed stationary over the thread of the frame, and one on a wooden support that reached from end to end of the frame. The brackets gave the best satisfaction, and the Superintendent has instructed me to continue my work, using the bracket in preference to any other idea. In company with the Superintendent I went among the operators to get their opinion as to the light, and found that they were of one mind, that it is just what they wanted, *and that they could now distinguish one color from another.* The jar or vibration of the building could not be detected in the lamp and I notice that when the ceiling is high the vibration is not so great as when it is low. I will watch close this feature, and if any trouble occurs from this source, will try and overcome it."

Mr. CLARKE, of the Pemberton Mills, Lawrence, Mass. finds by experience that the A lights are better adapted to the work than the B lamps. At fall River, Mr. SPENCER BORDEN thinks that one A lamp will give sufficient light for four looms in weaving rooms, but Mr. CLARKE prefers one A lamp for every two looms. In factories where we have placed the tin shades, we find by experience, that they give less satisfaction than the porcelain shades, and we are now putting in porcelain shades in preference.

BREAKAGE OF LAMPS. Our experience continues to teach us that there is no unusual breakage of lamps unless they are brought up too high, or unless the current is irregular. This experience is so uniform that the rule is well nigh established, that if the current is regular and if the lamps are run only at that candle power which they are made to be burned at, there will be no unusual breakages. Also it must be remembered that although lamps begin to break as soon

as a plant is started, the *average* life will always be found to be good. For instance, in running say ten lamps in order to test the life, "it is the last four of the ten," as Mr. Edison expresses it, "that brings up the average." We have never yet known the average to fail where the current is reasonably regular and the lamps are not forced too high.

(CONFIDENTIAL, AND FOR THE USE OF THE COMPANY'S AGENTS ONLY.)

SECOND BULLETIN.

The Edison Electric Light Company,

65 FIFTH AVENUE.

NEW YORK, February 7th, 1882.

PROF. PREECE ON THE EDISON LIGHT. The following is a quotation from an article on Electric Lighting at the Paris Exhibition, by William Henry Preece, F. R. S., of London, published in the *Journal of the Society of Arts*, London, December 16th, 1881.

"The completeness of Mr. Edison's exhibit was certainly the most noteworthy object in the exhibition. Nothing seems to have been forgotten, no detail missed. There we saw not only the boilers, engine, and dynamo-machine, but the pipes to contain the conductors; the conductors themselves, heavy and massive, for Mr. Edison recognises the waste of energy that must occur in small conductors, the insulation, the fixtures, the brackets, the safety catches, the lamps, devices to avoid the effects of expansion and contraction through changes of temperature, meters to measure the current used, regulators to control the consumption of fuel." * * * "Mr. Edison's system has been worked out in detail, with a throughness and mastery of the subject that can extract nothing but eulogy from his bitterest opponents. Many unkind things have been said of Mr. Edison and his promises; perhaps no one has been serveror in this direction than myself. It is some gratification for me to be able to announce my belief that he has at last solved the problem that he set himself to solve, and to be able to describe to the Society the way in which he has solved it."

THE EDISON LIGHT IN NEW HAVEN. The following is an extract from a letter written to Mr. Lowrey, one of our Directors, by a friend who has no interest whatever in the Edison Company, and who visited the establishments of Messrs. Sperry & Barnes, at New Haven, Conn., for the purpose of making a perfectly impartial report on the Edison Light there.

"Mr. Sperry himself showed me about and from him I learned that the system thus far had proved most satisfactory; that he had no trouble of any sort to find with it.

He told me that he had been looking at the lamps of different inventors for some two years, but had not been willing to use any of them until he saw the Edison.

As I understand it from him, the Edison system accomplishes what none of the others do, viz: the possibility of having a light over each workman, if necessary, and so avoiding shadows which with the arc light would cause trouble, and more especially where there are a number of work people. 'The possibility of having a light over each workman' also of course refers to the quality of the light which he says, and I for the first time realized it to be a fact, is such as to be most inoffensive to the eye. In fact all that Mr. Sperry said to me on the subject was in praise of the Edison system.

Mr. Sperry is, as you may know, a most practical sort of man (a fact at once seen in the effectiveness of the arrangement of his establishment), and any praise from him on this subject, especially coming to you in this indirect way, I thought you would be glad to know of."

THE EDISON LIGHT IN EUROPE. The following is a quotation from a letter just received from our representative in Paris.

"The five plants ordered to Hamburg arrived there yesterday, January 7th, and they go forward to Russia. They are all for Tammerford, in Finland, for the spinning factories there. The other one goes to the Imperial Docks at Dantzic, for their workshops."

EDISON LIGHT VERSUS GAS. The gas explosion at Newark Tuesday night left the Clark Thread Works in darkness except that portion which is lighted by the Edison Light. This isolated plant in the Clark Works has given entire satisfaction from the start. The residence of J. Hood Wright, at Fort Washington, (a member of the firm of Drexel, Morgan & Co.) would have been left in total darkness the other night, owing to the gas meter having been frozen up, had it not been for the Edison Light. Mr. Wright has placed an isolated plant in his residence, which lights the larger rooms in his house and some of the bedrooms. He expresses himself in the most gratifying terms about the success of the light. The store of Jaffray & Co., corner Leonard Street and Broadway, has been for some time lighted with two dynamos. They have given an order for two additional dynamos (four in all), and an engine is being especially provided to run these four dynamos. The American Bank Note Co., of this city, is now using an isolated plant, and finds the inverted lamp just the thing needed for fine engraving work. The light has been started in the wholesale grocery store of Thurber, in this city, but the foundation of the engine is not stiff enough and the light suffers in consequence. The foundation which has been built up a number of feet from the ground, owing to the peculiar requirements of the building, will now be made more secure. The isolated plant in the Merrimack Mills, Lowell, Mass., is giving satisfaction, the only criticism being, that probably whole lamps will have to be substituted for half lamps, the latter not giving sufficient light. Our isolated plants are giving good satisfaction everywhere.

STILLWATER ISOLATED PLANT Mr. W. S. Howell, who has installed the isolated plant in the Agricultural Implement Works of Seymour, Sabin & Co., Stillwater, Minn., writes, under date of January 30th, that "Messrs. S. S. & Co., do not hesitate to pay high compliment to the Edison Light, sparing no chance to say a good word for the light, and that they have really done us valuable service in answering letters of inquiry concerning its working."

PLANT AT FALL RIVER. We received a letter from Mr. Borden dated February 3rd, in which he speaks as follows, on the plant at the Fall River Bleachery. He says he wishes we could see the perfection of manner in which the system is working at the Bleachery, in the hands of people who only have a theoretical knowledge, and who started the system without asking a man to instruct them. No plant anywhere could run with more satisfaction, the dynamo running absolutely without more than the faintest indication of sparks, and perfectly cool, the light being clear, beautiful and steady.

LIFE OF LAMPS. A complaint having been made that the lamps do not last as long under some circumstances as under others. Mr. Upton, in charge of the lamp factory at Menlo Park, made the following comment upon the complaint. We quote it for the benefit of others in addition to him for whom it was written. Mr. Upton says:

"I showed the letter to Mr. Edison. He suggests that the lamps be run at a lower candle power, and that more lamps be added to obtain the light that the lamps were not intended for, i. e. 25 to 30 candle power, in order to give brilliant effects. These effects should be obtained by the addition of more lamps. Our 27 lamps put up here are certainly going to average 1,000 hours, simply because we keep them always at 16 candle power, and don't work the life out of them by misgoverned engines running them up at times to the limit of breaking. * * * There is scarcely anything more that can be said. The lamps last with us for we are very careful. A lamp burning at 48 candles lasts only 1-80 part as long as one at 16 candles, and the difference in the light is not exceedingly great. * * * Keeping the commutator in good condition I think has some effect. I believe that in a central station, where there are several machines and extremely careful regulations, the lamps will last much longer than they do with us. * * * Isolated plants give the hardest test to the lamps, and they will always be found to last fewer hours than they do in the larger plants."

(CONFIDENTIAL, AND FOR THE USE OF THE COMPANY'S AGENTS ONLY.)

THIRD BULLETIN.

The Edison Electric Light Company,

65 FIFTH AVENUE.

NEW YORK, February 24th, 1882.

SERVICE BOXES FOR CENTRAL STATIONS. Regarding under-ground service boxes in plants for central stations, Mr. KRUESI in order to test the insulation has had a service box with connections and tubes complete, as used in practice, immersed in water for three months, and the insulation is unchanged.

BALDWIN LOCOMOTIVE WORKS PLANT. Our Agent writes as follows from Philadelphia, February 17th, about our isolated plant running in the Baldwin Locomotives Works.

"The lights are running all right at Baldwin's. The dynamo has been moved into the new quarters set apart for electric light machines. The superintendent states that four lamps broken is the weekly average and that the length of time in use per week is thirty-six hours. This brings the life of the lamp squarely up to an average of six hundred hours. They are running the dynamo over 1,200, and they raise the candle power at least 15 per cent above what it ought to be, otherwise the lamps would last even longer."

PLANT IN THE UNITED STATES ROLLING STOCK COMpany's Shops, Chicago. We have received a record of the daily breakage of lamps in this plant, beginning November 22nd, and ending February 1st, together with a statement of the causes owing to which lamps gave out. The record was correctly kept in writing day by day by the Rolling Stock Company themselves. The net result shows 600 hours life for B lamps of hight volts, and with old sockets. The report made to us is as follows:

"The United States Rolling stock lamps have shown a life of 608 hours from November 22nd, 1881, to February 13th, inclusive There was no breakage from February 1st to the 13th. The dynamo is carrying a load of 127 B lamps. The plant is giving excellent satisfaction."

RUNNING WIRES IN STREETS. The City Government of Fall River passed a resolution, February 6th, refusing to permit any one to erect poles in the streets for carrying electric light wires. The Legislature of Rhode Island have under consideration a bill for the State of Rhode Island containing the same prohibition.

ONE HUNDRED CANDLE POWER INCANDESCENT LAMP. Mr. Edison has a one hundred candle power incandescent lamp running at the Lamp factory at Menlo Park. It requires 110 volts. Some are being made for London. Mr. Edison will now make some requiring a less number of volts to be run on our machine at No. 65 Fifth Avenue.

EDISON'S ELECTRIC RAILWAY. The electric locomotive is finished and is on the treck at Menlo Park. It has been run over the track and gives satisfactory resultes. The passenger car built by Stevenson is also on the track. The armature of the locomotive is the armature of the Z or 60 A light dynamo. Mr. Edison is now constructing also a freight locomotive and freight cars. This road at Menlo Park is built across the country back of Menlo Park, and is obout two and a half miles in lenght. It is well graded and will offer a practical illustration of the Edison Electric Railway. We can mail, on request, a copy of a pamphlet, a reprint of Mr. Clarke's article of December, 1880, on the Edison Electric Railway

IMPERFECT FIXTURES. Complaint has been made of imperfection in fixtures and sockets. Also that the safety wire in the

EUROPEAN COMPANY. On the 3rd of January, 1882, the entire amount of capital of the European Companies, namely three million five hundred thousand francs, was paid into a bank in Paris. Negotiations for the purchase of a factory at Paris have been finished and the purchase money for that (independent of capital) is ready to be paid. The railroad depot at Strasburg was lighted up successfully on the evening of January 5th. A contract is under discussion at Paris, for Spain. The proposed company for that country will probably have a capital of twenty five million of francs. A proposition has been received at Paris from Russia for the lighting up of Moscow at the coming coronation of the Czar. An agreement is nearly closed in Paris for lighting up the Western Railroad station in that city. Mr. Batchelor will have charge of the manufacturing at Paris.

LIGHTING UP NEW YORK CITY. Between six and seven miles of street mains have thus far been laid in the down town district. The bad weather has caused a suspension of laying mains for nearly a month. About six miles more mains must be laid. The third mammoth dynamo has been completed. The first one was sent to Paris where it was used during the last weeks of the exposition. The second one is now running in a building belonging to the Edison London Company, in the Holborn Viaduct, London. This third one, now completed, also goes to London. Mr. Edison is satisfied with the improvements in these dynamos and will now hasten the work on the uncompleted dynamos for the First District in this city. Six will be finished first, and after they are started in the Pearl Street building, another six will be finished to be placed in the adjoining building, which also belongs to our company. The meter to be used in the first district is completed and is satisfactory. It registers with almost absolute exactness. This gives still another advantage over the existing gas system, where the meter question is one of looseness and uncertainty. No time for lighting up the Down Town District can be fixed. The work is being pushed forward with

the utmost vigor, but the undertaking is so great, probably a few months must yet elapse before the district is actually lighted.

WIRES FOR SAFETY CATCH PLUGS. The following is a complete list of the size of wire required in Safety Catch Plugs, or to be used for a Safety Catch of any description, excepting the Safety Catch for a "Z" dynamo.

Gauge of wire B. W. G.	Diam. in inches.	No. of Lamps.
25	.020	3
21	.320	6
19	.420	9
18	.490	12
16	.065	15
14	.085	20 to 25
13	.095	30 " 35
12	.111	40 " 45
11	.120	55 " 60

Composition of the wire, 60 per cent. Lead.
40 " " Tin.

The column of lamps is for "A" or "B" when the latter are on a "B" line. If the "B" lamps are on an "A" line (two in series) half the total number of lamps will be the number in column 3. The sizes were experimentally determined and the wire will melt at approximately double the number of lamps in column 3. The "A" lamps give 16 candles, and the "B" lamps 8 candles.

CONFIDENTIAL, AND FOR THE USE OF THE COMPANY'S AGENTS ONLY.

FOURTH BULLETIN.

The Edison Electric Light Company,

65 FIFTH AVENUE.

NEW YORK, February 24th, 1882.

SUCCESS OF ISOLATED PLANTS. We are receiving letters from parties useing our isolated plants, expressing great satisfaction with the light. Some of these letters are printed in this bulletin, and additional ones will be printed in future numbers.

STEAMSHIP COLUMBIA. This is the first plant ever put in operation in the hands of strangers. It has now been running nearly two years, the longest test ever given to any incandescent light in any part of the world, and the following letter shows with what success.

"FEBRUARY 24, 1882.

THOMAS A. EDISON, ESQ:

DEAR SIR—In answer to your request for a report upon the working of the Edison electric light on board of the Oregon Railway and Navigation Company's steamship "Columbia," and its advantages for steamboat lighting, I beg to submit the following:

In 1879, while the "Columbia," which contains a large number of passenger rooms, was under construction, President Villard conceived the idea of lighting each room in the vessel independently by the electric light. Thereupon, at your suggestion, and by his orders, I wired the ship with number eleven wire for mains and number thirty-two wire for loops, insulated by double cotton paraffine and painted over all. The wires were run throughout the entire vessel, but the project at that time being experimental, we lighted only the passenger rooms and main saloons. The dynamos, of which we had four, one of them running at half of the speed of the others as an exciter or fielder were of the class you now call "A," and were all run from a countershaft directly overhead, driven in turn by a pair of vertical engines at a very high angle in order to economize freight space. On the night the 2d of May, 1880, we started up the dynamos, and from the time

when the steam was first turned on until the present they have worked to our entire satisfaction under all circumstances.

We found the light of the greatest value for the examination of the ship's propeller, rudder or hull, which examination we conducted by connecting to a main line aft, or at any convenient point, a coil of insulated wire with lamps attached to a sinker.

The first lamps used, being of the paper carbon variety, were irregular in their duration of life and so liable to breakage by heavy shocks that I found it best to suspend them from the wires above, and to do away with sockets entirely. The lamps being surrounded with a ground globe, the attachment was hid, the lights being suspended from the ceiling. Since the arrival of the ship on the Pacific coast we have received a full supply of new bamboo carbon lamps. How well these have worked can best be seen from the following report of Chief Engineer Van Duzer: "I have now one hundred and fifteen lamps in circuit, and have up to date run four hundred and fifteen hours and forty-five minutes without one lamp giving out."

The engines being connected to the main condenser when under way, the actual expense felt consists only in the extra pint of oil used in lubricating engines, dynamos, etc. The expense from coal at $6 per ton is about 18 cents per hour for the one hundred and fifteen lights.

In conclusion, I would say that the advantages of the electric light on board of ships can only be appreciated by experience. Among these advantages the principal are enumerated below:

1. Economy. The light does not require the services of an attendant for trimming, lighting, etc., and there is less breakage.

2. Freedom from danger by fire; no matches being required.

3. Ventilation. It is not necessary to keep doors and windows shut on account of smoking lamps or to prevent their being blown out.

4. Cleanliness and absence of disagreeable odor.

The advantage of a non-smelling light at night in sick rooms is manifest.

Respectfully yours,

J. C. HENDERSON,

Advising Engineer of Oregon Railway and Navigation Company and Oregon and Transcontinental Company."

HINDS, KETCHAM & CO., NEW YORK. A little more than a year ago, Messrs. Hinds, Ketcham & Co., lithographers and printers of colored labels and show cards, introduced the Edison light into

their establishment, No. 449 Water St., New York City, for the purpose of seeing whether they could match their colors, and do their colored printing by artificial light. Up to that time they had been able to work only by day light. The experiment proved successful. They found they could work by our light just as well as in the day time. The following letter expresses the opinion of this firm about the light.

New York, February 23d, 1882.

THE EDISON ELECTRIC LIGHT CO.:

DEAR SIRS—We have had the Edison system of incandescent electric lighting in our factory buildings since January, 1881, and take great pleasure in testifying to its perfection, simplicity, and the many other good features it possesses.

We have found it to be entirely free from all the faults and objectionable features of other artificial lights, and is the best substitute for daylight we have ever known and almost as cheap.

Very truly yours,

HINDS, KETCHAM & CO.

ORANGE COUNTY WOOLEN MILLS. This is the first plant ever introduced into a woolen mill. The following letter from Mr. Harrison shows what he thinks of it.

NEWBURG, N. Y., FEB. 11th, 1882.

THE EDISON COMPANY FOR ISOLATED LIGHTING:

GENTLEMEN—I believe my mill was the first building outside of your own works that you lighted with your electric light, and therefore it may be called No. 1. Besides being *job* No. 1, it is a *No.* 1 job, and a *No.* 1 light, being better and cheaper than gas and absolutely safe as to fire. I expect the difference in insurance rates will pay the whole expense inside of two years, and after that is done, said difference will pay the *entire* expense of lighting my premises and leave me a handsome amount annually besides.

JAMES HARRISON.

WINONA MILL COMPANY. This plant is in a flouring mill and is the first establishment of the kind ever lighted by an incandescent light. The letter speaks for itself.

WINONA, MINN., Feb. 16th, 1882.

THE EDISON COMPANY FOR ISOLATED LIGHTING, New York:

GENTLEMEN—Yours of the 10th at hand and noted. We are pleased with the Edison light. It is a very pleasant, steady light, and fully answers our purpose, for we regard it as perfectly safe, much more so than gas or closed lanterns, for it is simply impossible to fire a building or cause one of the (much to be dreaded) explosions that flouring mills are liable to when lights are carelessly used. We have used it constantly since December last, and it more than meets our requirements You are at liberty to refer any inquiring friend to,

Yours truly,

WINONA MILL CO.

DOLGE'S PIANO FACTORY. The following letter relates to one of our isolated plants now in use in the piano-forte factory of Mr. Alfred Dolge, at Brockett's Bridge, N. Y.

NEW YORK, Feb'y 18th 1882.

THE EDISON COMPANY FOR ISOLATED LIGHTING, City:

GENTLEMEN—Having now had your electric light in constant use at my lumber mills, Dolgeville, Herkimer Co., N. Y. long enough to be a competent judge of its merits, I take sincere pleasure in stating that it fully answers all my expectations and is giving entire satisfaction in every respect. The illumination of the machine halls is, through judicious distribution of the single lamps, so perfect that there is no shadow at all, every part of every machine is distinctly visible, and the halls are actually as well adapted for work when lit up, as on a sunny midday.

The light, though very strong, is at the same time mild and in no manner unpleasant or injurious to the eye; it enables my workmen to clearly distinguish the most delicate shadings in the color of their material—an item of great importance in so nice an article as sounding boards for pianos—as well as the qualities of its grain, and is, in short, much better adapted to all purposes than I had dared to expect.

I must add that, with ordinary care, the apparatus seems little likely to ever get out of order, and certainly furnishes a more uniform supply of light, with less trouble and attention required, than any other system of illumination I am acquainted with.

I expect to illuminate my new felt works at Dolgeville, which I hope to complete this fall, with nothing but your electric light, and in

the meantime congratulate you most sincerely upon your truly great success.

Very respectfully yours,

ALFRED DOLGE.

FALL RIVER BLEACHERY. The first isolated plant ever introduced at Fall River, was in the Fall River Bleachery. The following letter refers to that plant.

FALL RIVER, MASS., February 21st, 1882.

THE EDISON COMPANY FOR ISOLATED LIGHTING:

GENTLEMEN—In answer to your question concerning the Edison light at the Fall River Bleachery, I beg to say:

We are running 50 of the A lights at 20 candle power, and 40 B lights at 10 candle power each, in connection with a single Z dynamo, which you guarantee for 60 A lamps.

This single apparatus lights our entire establishment very beautifully, and a single leather belt 6 inches in width, incapable of transmitting over 8 or 9 horse power, furnishes the power.

The apparatus is in charge of an intelligent carpenter in our employ, who has had entire care of it from the first. The light is perfectly steady and soft, our help are greatly pleased with the change, and visitors to our works greatly praise it.

One of the most conservative of our Fall River manufacturers said on seeing our finishing room, where we have 45 A lights, that he had never seen a room so beautifully lighted.

When we consider that the apparatus takes less power than one of our calenders and saves us our gas bills, which were between $200 and $300 for the three winter months, though we made our own gas, we feel there is abundant cause for satisfaction with the Edison light, and reason to congratulate all connected with its introduction.

Yours very truly,

SPENCER BORDEN, Treas.

MANHATTAN RAILWAY COMPANY'S SHOPS, NEW YORK CITY. The following letter shows what success one of our isolated plants is giving in the repair shops of the Manhattan Railway Company.

NEW YORK, MARCH 4th, 1882.

THE EDISON COMPANY FOR ISOLATED LIGHTING.

"DEAR SIRS:—The Edison Electric Light plant put in our Machine

Shops last Autumn has worked with entire satisfaction through the winter. We have not had a failure of any kind and but a very small number of lamps were broken, the cost of maintenance has been practically nothing and the cost of operation we have not been able to determine. We drive directly from main line and can not perceive any increase in the amount of fuel consumed, there no doubt is an increase but it is very small in this case.

Very respectfully,

T. W. PEEPLES,

Master Mechanic.

GOVERNMENT PRINTING OFFICE, WASHINGTON. We have received the first number of the Congressional Record printed by the Edison Light. The following telegram from Washington to the *Boston Daily Advertiser*, and printed in the issue of that paper, February 25th, is a correct account of starting the light in Washington.

"WASHINGTON Feb. 24, 1882.—At the government printing office, tonight, seventy of Edison's electric lights were used as a substitute for twice that number of gas-burners used by compositors at their cases. The beautiful steady white light gave great satisfaction. At 9 o'clock the electric lights were turned off and gas was used for two hours. The printers were all impatient for the electric light which was again brought into use at 11 o'clock. The lamps are very pretty in appearance, lighted or unlighted. Each one could be extinguished or lighted instantly, at pleasure, or all could be extinguished or lighted at once. It was noticable that when the gas was lighted the temperature rose several degrees, and when it was extinguished the room became several degrees cooler within half an hour. This is an important consideration where so much gas is burned that no other heat is supplied in winter. The expense of the seventy lights is calculated at ten cents an hour, a great saving over burning gas. In calculating power for the generator one horse power is reckoned ample for seven lights. All the employees at the office expressed great satisfaction with the experiment."

MILAN, ITALY. The following cablegram has been received from Milan, Italy, "The Grand Foyer of La Scala (Opera House) just lighted up with ninety Edison Lights The Mayor and Board of Aldermen have inspected the light and are delighted."

MERRIMACK MILLS, LOWELL, MASS., The following is an extract from an article in the *Lowell Morning Times*, Feb. 21st, with reference to our isolated plant in the Merrimack Mills.

"One would hardly notice the difference between this light and the ordinary gas light were it not for the increased brilliancy and the enclosure of the light in a little pear-shaped glass globe. There are 262 lights in the room, one over each loom. These lights are affixed at one end of an iron pipe, through which from the ceiling run the wires from the main. The mains are carefully insulated, and are placed over the long aisles between the machines. All the lights are controlled from one point, though a switch may be put on each lamp. The currents are furnished by two dynamo-electric machines in the basement, consuming about 18 horse power. It is gratifying to note how completely protected these machines are from possible accident by shock to anyone near them. One of the most important, if not the main feature of the Edison light is the protection against fire from the wires, and this safety is ensured by a curious means. In the arc system the brilliancy of the lights is given by the passage of an electric current from a positive to a negative pole, kept slightly apart, and as the current leaps over the intervening space there is formed what is known as the voltaic arc. The Brush and Weston lights are examples of this class. In these system there is necessarily a certain percentage of danger arising from the high electro-motive force used in maintaining the light. In the Edison incandescent system the electro-motive force is only about one-thousandth part of that employed in the arc system, and, in addition to the lessened liability of danger from this source, the risk is reduced to a minimum by the use of Edison's fusible cut-off. This contrivance is placed wherever a line is tapped. The Company are well satisfied with the lights, and operatives find them very agreeable to work by. They give off no heat, and the color of the light is but a trifle whiter than that of gas, and not at all trying to the eyes. The lights at present in use are eight-candle power each, and the cost of maintenance is less than one-third that of gas."

The following is an extract from the *Lowell Morning Mail*, also February 21st, about the same plant.

"The general arrangement of the apparatus in the lower weave room of Mill No. 2, where alone it has been introduced, has been fully described in the Mill, and it only remains to mention the impression made upon one who observed the working of the incandescent system for the first time, although not unfamiliar with its principles, and to

refer to such new facts as were learned respecting it. Standing at one end of the room and glancing down the long rows of looms, each with its own little light placed three feet above the fabric being woven, one is first struck by the agreeable quality of the light, and next by its perfect steadiness. Flickering is absolutoty impossible, and no variation in intensity was to be noticed. These qualities are, of course invaluable in any light, and for some purposes it is plainly to be seen the incandescent electric is better than sunlight, which is liable to be obscured by passing clouds. The absence of heat is another valuable quality in this light. Although the little pear-shaped globes containing the lights are slightly warm to the touch they radiate but little if any heat, and the temperature of the room, which would be raised ten or twelve degrees by the lighting of the gas, is not influenced by the 262 electric lights. Upon approaching a loom and examining the work in process, it appears that every thread, every line of the pattern in fancy plaided white goods, is remarkably clear and distinct; imperfections are quickly noticed and as quickly remedied, and it would seem that the operatives could desire no more perfect light to help them about their work. A particularly noteworthy feature of the Edison Company is the system of "shut-out" employed wherever the main wires are tapped or branches or connections made. This "shut-out" is an ingenious but very simple contrivance by which a fusible leaden wire is melted at the instant the main or branch wires become crossed or in contact with any conducting substance, averting all danger from fire and enabling the company to make a guarantee of perfect immunity in that respect. Yet another peculiarity of the company is that in their system for lighting towns or cities, for domestic or business purposes, all the wires are conveyed under ground, in tubes especially contrived to admit of connections being made at any point desired. For house or office use, meters are provided to measure and register the current, and any single light may be extinguished by a turn of the hand without effecting any others that mao be in use, and instantly relighted in the same manner."

EDISON LIGHT IN THE CRYSTAL PALACE EXHIBITION, LONDON. We have been shown a letter from Mr. F. Ricard Seaver, F. R. S., of Edinburgh, dated London February 8th, 1882, from which the following extract is made.

"The Crystal Palace Exhibition will do a great deal to advance electric lighting, and your exhibit in my humble opinion does the greatest credit and honor to its organizers and will with every justice carry off the first prize. I have frepuently gone over the various

installations both there and at No. 57 Holborn Viaduct, and it is something marvellous to note the precision and perfection reigning in every little detail. Mr. Edison may be proud of his work and I trust his reward, not far distant, will be in proportion to the magnitude of his merits."

UNDERGROUND WIRES. A hearing has taken place this week before a special committee of the Rhode Island Legislature, regarding the proposed legislation in that State to compel electric light companies to put their wires under the ground. The leading electric light companies were represented at the hearing. A friend of the Edison company showed samples of the Edison underground conductors, and stated that the Edison company was in favor of the proposed legislation. A representative of a prominent arc light stated at the hearing, that it would be impossible for the arc lights to use underground conductors, for the reason, as he expressed it, that "a different kind of electricity, of far greater electro motive force, was required for the arc light, from what was required for the Edison Incandescent Light, and that there was no method of carrying this different kind of electricity underground." Reference was made to the vast number of fires caused by the arc system, and especially to the fact that over eighty fires have already been caused in Philadelphia alone, by arc lights, many of which occurred in the Pennsylvannia railroad depot in connection with the arc lights in that building. On the other hand, it was said (and it is a fact), that although the Edison electric light is now burning in more than fifty factories and public buildings in the United States, and in nearly as many more outside of the United States, there has yet to be the first fire from the Edison light.

PEARL STREET STATION, NEW YORK. The frost is out of the ground, and the laying of the underground conductors in our

first central station district in this city, has been resumed. Mr. Kruesi is now laying about a thousand feet a day, and the work will be pushed forward with all possible energy.

FIFTH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the Vice President whatever practical points of general interest may be developed by their experience in installing or operating our light.)

New York, March 17th, 1882.

Mr. EDISON'S AWARDS AT PARIS. The company has obtained officially a statement of the awards made to Mr. Edison at Paris by the recent "International Congress of Electricians." The Congress subdivided its work among juries, to each of whom certain special subjects were assigned. The highest possible award the Congress could give was a Diploma of Honor, that being higher than a Gold Medal. The final award to Mr. Edison, made by the several juries, was three diplomas of honor, two gold medals and a silver medal. Pursuant to usage, however, the Congress reserved the right to reorganize awards, so as to give to each exhibitor the highest award which he had received in any one class, and the Congress therefore approved the recomendations of the juries, and itself awarded a diploma of honor to Mr. Edison. Altogether there were only eleven of the highest possible awards (the diploma of honor) granted by the full Congress, and of these only two were given to Americans, namely, one to Mr. Edison, and the other on account of the telephone. The only diploma of honor awarded for an incandescent electric light

was awarded to Mr. Edison. In addition to the foregoing awards, Mr. Edison received from the French Government the decoration of Officer of the Legion of Honor. He had been previously made Chevalier of the Legion of Honor, but the higher rank of Officer was conferred on account of his exhibit at the Paris Exposition.

PLANT IN THE HOTEL EVERETT, NEW YORK CITY. The Hotel Everett, formerly "Crooks," 86 Chatham Street, is lighted by an Edison isolated plant. There are one hundred and one lights in the entire house, forty-four being in the main dining hall. The chandeliers for the lights are unusually expensive, and present a beautiful appearance. On the second floor is the office and reading-room, also the hotel parlors, all lighted with the Edison light.

THE EDISON LIGHT AT MILAN. *La Perseveranza*, a newspaper published at Milan, Italy, contains in its issue of February 12th, an account of the lighting up of the foyer of la Scala with the Edison light. The report states that "The success could not have been more complete, and was all the greater because comparision could be made with the gas lighis in the adjoining halls. Three chandeliers containing ninety-two Edison lamps were lighted. All acknowledge with admiration the beauty of the light and the wonderful simplicity of the Edison System. It was indeed a success." Another Milan paper, *La Lombardia* in its issue of February 21st, states that "The experiment of the Edison light made in la Scala has demonstrated that the problem of electric lighting is solved, and that nothing remains to be done but to apply it on a large scale". Another Milan paper, *Il Secolo,* contains an article on the Edison light, from which the following extract is made: "Motors, electric generators, systems of distribution for streets and houses, regulating and moderating devices, apparatus for measuring the quantity of electric

ity consumed, safety appliances, all were brought forth from the mind of this extraordinary man, and all were wonderfully worked out from a practical point of view, perfect in simplicity and durability. The light emanating from the lamp, which is produced by the incandescence of a filament of carbonized bamboo shining in an evacuated glass globe, is steady, mild, inoffensive and, above all, does not have that ghastly white color which renders some other lights so disagreeable."

EDISON LIGHT IN RUSSIA. The following despatch has been received by the company, via Paris. "St. Petersburgh, Russia, February 23rd. First lighting by the Edison system in Russia began here to-night and was a grand success."

THE WINONA MILL PLANT. The Winona Mill Company, Winona, Minn., in remitting a check to pay for their plant, write as follows: "We enclose draft to balance account, and we believe we have the best light known and do not hesitate to say so."

ISOLATED PLANT IN CHICAGO. An isolated plant has been started successfully in the wholesale dry goods stores of Messrs. Marshall Field & Co., Chicago. The light gives such satisfaction that a duplicate plant has been ordered for the retail store of the same firm. A plant has also been put in successful operation in the store of Messrs. Rand, McNally & Co., Chicago.

EXTRACT FROM THE BOSTON TRANSCRIPT. The following is an extract from the Boston Evening Transcript, March 3rd, 1882.

"For the past ten months the Edison incandescent lighting system has been in practical use in a large number of industrial institutions throughout this country. Supposing we make a flying tour of inspection. Visit Lawrence, and we will find the lights in question illumina-

ting the Pemberton and Arlington Mills; trip across to Lowell, and you will discover two hundred and sixty-two in the Merrimack Mills; back to Boston, and a call at the Boston Sugar Refinery, will disclose one hundred and twenty-eight. Proceed to New Bedford, and you will find the same system in the Wamsutta Mills, and so on through Glenville and New Haven, Conn., until you reach New York. Here we will find the Edison incandescent lights in use in such places as the American Bank Note building, Manhattan Elevated Railway shops, H. K. & F. B. Thurber's, wholesale grocers, etc. On our way to Philadelphia, if we should drop off at Beatty's large organ factory, at Washington, N. J., we would find the buildings illuminated with Edison's lights, and the same discovery would be made at the Clark Thread Works and the locomotive works at Paterson. Reaching the City of Brotherly Love, should we call at the Baldwin Locomotive Works and John Stetson's hat factory, we would find them there, and so on throughout the entire West and Northwest, notably in the United States Rolling Stock Company's works at Chicago, Ill., and Urbana, Ohio, and Winona Mill Company's mill at Winona, Minn., the third largest flour mill in the country. Visiting Paris, upon inquiry we will learn to our astonishment that, at the recent electrical exhibition held in that city, Edison's incandescent light figured so prominently that it won for its inventor the diploma of honor *over all other systems of electric lighting.* Homeward bound via London, if we should happen to pass through Strasburg we would find the railway station in that city likewise lighted by Edison's lamps.

As to the question of cost, one of Edison's dynamo machines, capable of furnishing one hundred and thirty lights of eight candle power each will require only nine horse-power to drive it and since, by proper management, it is very simple to obtain one horse-power per hour out of every three pounds of coal placed in the furnaces, these one hundred and thirty lights, aggregating ten hundred and forty candle power, can be maintained at the small cost of twenty-seven pounds of coal per hour, and this too in isolated buildings where the consumer furnishes his own power. Under these circumstances gas would have to reach a very low price indeed to compete with this system."

"The Edison Illuminating Company, the local corporation which has for its object the illumination of New York city, having secured from the Municipal Government the franchise of opening the streets, have been actively engaged, for a number of months past, in preparing to illuminate its first district. This district embraces all the territory bounded by Wall street on the south, Spruce street on the north, Nassau street on the west, and the East River on the east. In this district is located the central station, containing all the engines, boilers and dynamo machines necessary for generating the electrical current

for supplying the consumers, over one thousand having already contracted for the use of the light. From this station the conductors run through the streets, being conveyed in iron pipes thoroughly insulated, and buried underground to the depth of eighteen inches. In front of each building are branch pipes running into the basements where connection is made with the wires arranged throughout the house. Each consumer will be provided with an electric meter, through which the current will be passed and accurately registered, so that, should one only burn a light for five minutes in a day, one would simply be charged for the amount of current consumed during that time."

"Both the electric tubing and the electric meter have been thoroughly tested, the former having been in use, covering a number of miles, at Menlo Park, N. J., and have been found to be perfect in all their details."

"That sooner or later all the electric lighting companies will of necessity adopt some system of underground conductors admits of no discussion; but thus far Mr. Edison has been the only one to arrive at a satisfactory solution of the problem, and he claims for his entire system such safety, economy and superiority as will enable him to compete successfully with the gas companies generally."

ELECTRIC LIGHTS IN HARTFORD. The City Government of Hartford is considering the question of requiring all electric light companies to place their conductors under the ground. A hearing took place before the Board of Street Commissioners and a joint special committe of the Board of Common Council, March 7th. The *Hartford Courant,* March 8th, gives the following account of what took place:

"The subject of the best manner of conducting electricity so as to avoid danger of fire, was discussed; also whether electricity could be conducted in cables underground; also as to what restrictions should be placed upon the system of placing wires on poles. A piece of Edison's underground cable was exhibited, and it was stated that the Edison Electric Light Company formerly had six miles of underground cable laid at Menlo Park, covering an area of about one half a mile square; that all through one winter they ran the current through the street mains, lighting about seven hundred lamps distributed over the area, and that it has been tested by outside experts, and reported that the system of underground cables has been demonstrated to be an absolute success, and the loss from leakage less than one per cent.

It was also stated that the Edison company is now equipping a district of a mile square in New York city, where the electric current will all be sent through subterranean cables laid in the streets, from a single central station, where it is generated. In that district they have already wired for the Edison lamp 946 houses, aggregating 14,311 Edison incandescent lamps. Beside light, the company will also sell electric power for domestic and industrial purposes. The restrictions placed upon the putting up of poles and posts in New York city, Cincinnati and other cities were read, also the rules of the Board of Fire Underwriters in New York city and Massachusetts in the use of electricity."

ELECTRIC LIGHT AND ACOUSTICS. It is said that a marked improvement has been noticed in the acoustic property of theatres where the electric light is used. A layer of heated gases act as a screen for sound, hence the volumes of hot fumes arising from the old gas foot-lights obstructed and marred, to some extent, the voices of the singers. With the electric light, inclosed in air-tight bulbs, no fumes can be emitted, and very little heat is given off. Hence it benefits the ear as well as the eye.

EDISON LIGHT IN THE NEW YORK HERALD. We have wired the Herald Building for 72[illegible] lamps. The dynamos will be placed in the Bennett Building, corner of Nassau and Fulton Streets, and the current there generated will be taken up Ann Street in the Edison underground conductors, to the Herald Building. Mr. Bennett is expected back from Europe in a few weeks and the building will not be lighted up until after he returns.

THE EDISON LIGHT IN FALL RIVER. The following extract is from the *Fall River Daily Sun* of March 10th.

"Having a desire to see the place and machine where the Edison electric light was being produced, the writer accepted an invitation from the managers of the light in this place a few evenings since, and proceeded to the Pocasset Mills. In the western basement is station-

ed a little engine of 17 horse power engaged in making faster time than was ever accredited to Goldsmith Maid, for the purpose of turning a small cylinder at a terrible rate of speed. We do not know the scientific terms but believe this cylinder is the armature. Just above the armature are seen four black looking pillars, perphaps ten inches through and five feet long, connected at the top and resting on large blocks of iron. These constitute immense magnets, the blocks of iron being the magnetized poles. When these poles are not fully magnetized the armatures can be readily turned with the hand, but when everything is in operation it takes all the power of this little engine, made by Armington and Sims, of Providence, to overcome this resistance. What is this resistance? one asks. Just for an illustration, suppose you take your knife, open the blade and hold it near those blocks of iron. You will feel the drawing power of that magnet. Don't get too near with your watch or its springs may become magnetized. Now this is the "resistance" to that engine. The electricity is generated and is driven out through the wires that you see in the street, as water is driven through a pipe; perhaps this explanation will give the unscientific reader an idea as to how the electricity flows along the wires. Along the water pipe in the streets are little pipes leading to the houses. So along the wires the electricity is tapped and out pours a stream of light. This may be a homely way of expressing it, but it gives the reader a rough idea of the working of the lights. At present there are 127 lights being driven by this engine, each light of 20 candle power. Last Saturday night they were kept burning 7 hours without a hitch excepting the lights were turned off once. As the amount of electricity required for a large number of burners is larger than for a small number, there is an arrangement called a "resistance box" where the whole power can be regulated. No doubt on Tuesday night some persons saw the lights go out for an instant and they wondered what the matter was. It was nothing more than that the dial hand of the "resistance box" was turned round—just to show the writer how it could be done—and out went the "electric." This is economical for the company who makes the light, as only the amount required need be furnished; all that needs to be done is to adjust the "resistance box." Many have read of the danger lurking in the subtle electric fluid, and have been informed that electric machines endanger people's lives. We were invited to try how gentle the electric shock was, and we will admit that it took some faith to make the experiment. It flashed through our minds, "what if something is wrong and we should be struck down as by lightning." But being assured there was no danger we proved it by taking hold of the wire; hardly a shock was perceptible, so evenly was it distributed to all the lights. Then to guard against fire there are ample precautions. It

may be thought by some that an extra amount of electricity can find its way to a portion of the wire and do harm. But this is guarded against by a little lead wire which is melted when the heat is too great, and the connections are broken before any harm can be done. There is absolutely no danger from the Edison system. The little burners that are giving such a beautiful light can be used 600 hours, then they are destroyed and new ones substituted. This electric light is being admired by all for an indoor light and it does look as though the "electric" is to be the future light. The gas companies once got a scare and recovered, but it now looks as though man's inventive genius will overcome all obstacles, and gas will some day be given the cold shoulder."

PROGRESS IN NEW YORK CITY. A precise statement of the progress made in laying the underground conductors in the first central station in New York City, may be of interest. The total length of underground conductors for the entire district is 73,313 feet. Of this amount, 39,403 feet were laid prior to March 1st. 1882, leaving 33,910 feet yet to be laid. The frost now being out of the ground, the work is progressing in good weather at the rate of about one thousand feet a day. The underground conductors used by the company are an invention of Mr. Edison, for which a patent (No. 251,552) has been issued.

EDISON LIGHT IN THE CRYSTAL PALACE, LONDON. The following extracts are from the *London Globe* of February 15th.

"At length the Electric Exhibition at the Crystal Palace begins to assume something of the attractiveness which the public have been looking for a month or two past. * * * At present the palm must be awarded to Mr. Edison's display. His section of the exhibition is apparently complete, and it cannot be questioned that the display he furnishes settles finally all doubt as to the triumphant success of electricity for interior lighting. We shall not, of course, be understood to be expressing any opinion with regard to considerations of expense, but so far as the nature of the light and its applicability to every possible requirement of domestic use are concerned, it is difficult to avoid speaking of this display in terms which may savour of enthusiasm, if not of exaggeration. The concert room is entirely

lighted by electric lamps, and the great merit it is intended to present, we suppose, consists in the illumination having all the best characteristics of gas lighting, and absolutely none of its defects. There are festoons of small lamps, perhaps 150 of these round the galleries, there is a cluster of them in a crystal pendant hanging from the roof, and there are a few lights dispersed under the galleries. Altogether the effect is that of gaslight, only more brilliant. There is none of the ghastly whiteness that used to be felt a fault, but just a soft, brilliant yellow light, and to show the possibility of diminishing the light to any point, Mr. Edison's name is exhibited over the organ in small lamps, appearing, as seen from the body of the hall, to be presented on a board of about a yard long and a foot wide. The entertainment hall, on the other side of the Palace, however, is the crowing triumph of this inventor's system. There is an enormous gilt pendant in the centre of the room, lighted up by about a hundred lamps, and about the room are pendants, brackets, table-lamps, &c., in all sorts of forms, some of them arranged to permit of visitors testing for themselves the facility with which the light may be turned on and off, a tap, just as in the case of gas, affording the means both of extinguishing and relighting. There is at one end of the room a large billiard-table, beautifully lighted up, and at the other a miniature theatre stage. This entertainement hall is really a magnificent display of a system of lighting beyond which it is impossible to conceive of an improvement, and assuming that it can be carried on at a cost approximating to that of gas, its universal adoption must be held to be an absolute certainty, and that in a very short time."

The *London Daily News* of February 27th, contains a long account of a visit of the Duke and Duchess of Edinburgh, to the Electrical Exhibition at the Crystal Palace, London, February 25th. The following extracts refer to the Edison light.

"Passing southwards past the great stage, they entered the Concert Room, where was seen one, but by no means the principal, display of the Edison electric lighting system. The remarkably steady incandescent lamps arranged on the ladder principal hung in festoons all around the galleries and in front of the organ. Above the organist's seat the name "Edison" shone forth in letters made up of the bright lamps. From the ceiling was suspended in the centre a crystal chandelier sparkling with the Edison light. Pendant lights also illuminate the platform, while the space under the galleries was illuminated by pendants of lights, springing like petals from the inte-

rior of flowers, of variously coloured glass. These were specially observed by the Duke and Duchess. • • • •

"The Edison display in the Entertainment Court was in point of taste, perfect, and as an illustration of the domestic uses of electricity complete. The central attraction of this tastefully arranged display is an enormous gilt chandelier of elaborate floral design, into which Messrs. Verity and Son have evidently put their best work as art metal-workers. Conspicuous in the metal work is the repetition of that blossom of æsthetic age, the sun-flower, yet it does not obtrude itself as its posturing admirers are reputed to do, but rather contents itself with the position of a modest foil to other flowers, which, being severally endowed with a corolla of tinted glass, have the distinction of radiating the light. At the will of the lighter 120 variously-hued flowers blossom on this golden tree, growing downward from the ceiling. You open a little secret door in the panelling of your wall and there discover a handle ready to be turned. Screw it one-third of a turn to the right and you have a third of your lights turned on; one more touch and a third more of your flowers are blooming and imparting fresh light; complete the turn of the handle and the full brilliance of your chandelier is displayed. This is the application of the Edison light to the assembly-room. In other parts of the room neat lamps, neatly arranged, exemplify the use of the light in parlour or library, and particularly its admirable illumination of the billiard table. The devices for the boudoir are particularly striking. For example, in the interior of wall mirrors with bevelled glass frames is placed an incandescent lamp, and light is thus thrown on to the surface of the mirror from the bevelled sides in a manner which should occasion the despair of manufacturers of mirror candelabra. There is in this device also the suggestion of a mode of illuminating works of art. An extremely neat electrical cigar or pipe lighting apparatus much amused the Duke of Edinburgh and his friends. In front of a small porcelain column are arranged vessels containing pipe-lighters of metal immersed in a inflammable liquid. On the withdrawal of any of these from its place an electric current which was hitherto presumably found a short cut to its destination through the end of the pipe-lighter has to follow a new route which leads it through the interior of the porcelain column and out to a globe on the top, where it meets with a small spiral of wire. By the time the smoker has got the pipe-lighter fairly out of its socket this little spiral is approaching white heat, and your have but to apply the soaked pipe-lighter to obtain the needed light. Replace your lighter in its socket, and the light almost instantaneously disappears. This simple but ingenious application of the electric current to the wants of the smoker, may be commended to the earnest attention of the Anti-Tobacco Society, for

who knows whether smokers may not be demanding its adaptation for their convenience to every lamp-post through which the current passes, as an immense improvement on the antiquated *pro bono publico* lantern of accommodating tobacconists? The manager of the Edison system in this country, Mr. E. H. Johnson, who has every reason to be gratified at the appreciation of his excellent work manifested by his distinguished visitors, showed them, in addition to the various things already mentioned, the mains by which under this system the wires would be carried through the streets, and explained the manner in which the houses would be supplied and security afforded against danger. The experiment of breaking an incandescent lamp was made to show, as was some time ago proved at the Savoy Theatre, that the accidental breaking of an incandescent lamp is attended with no other inconvenience than the extinction of the light till another lamp is found."

The *London Daily Chronicle*, also of February 27th, gives the following account.

"Certainly to Mr. Edison must be accorded the merit of making a magnificent display of the latest things in electric lighting. Not content with illuminating the concert room by means of his incandescent lamps, he has taken possession, for miscellaneous exhibits, of the Entertainment Court, and here the Royal party spent a considerable time in inspecting what was to be seen. Apparently the object of Mr. Edison is to indicate that the electric light may be put to all uses to which gas or candle has hitherto been turned. He has the model of the proscenium of a theatre fitted up with a row of electric foot-lights; a billiard table with electric lamps over it; a reading table with a shaded electric lamp for the student, and an electric pen: an electric-lamped chandelier for a room; an electric hall lamp; a bracket, like the ordinary gas fixture, fixed to the wall, with an electric lamp attached, which may be lit and extinguished at pleasure by turning a button; and mirrors for dressing-rooms with electric lamps pendant at each side. The chamber is of resplendent brilliancy with all these lights burning, aided by a massive gilt chandelier, studded with electric lamps in the centre. By the easy mode of turning off and on, the different lights there is amply demonstrated the subdivision of the electric light and its adaptability for house-hold requirements".

The following extract is from an article in the *London Metropolitan* on the subject of the Crystal Palace Exposition.

"The chief labours of Mr. Edison in electrical lighting have been devoted to the production of a system for general and for domestic purposes. To this end, from the outset he selected the incandescent light, and in all his efforts he has kept rigidly to this system, and has striven to generate the particular class of current required for its service in the most economic way." * * * *

"For ourselves we have no hesitation in saying that, for indoor purposes, we have never seen a light more efficient as a means of illumination, or more pleasant to those assembled under its influences."

The following is an extract from the *Journal of Gas Lighting*, London, February 21st. 1882, regarding the Edison Light in the present electrical exhibition at the Crystal Palace.

"The admiration of the public is reserved for the incandescent lamps, which are present in great numbers, and make a most effective show. The small pavilion designed to exhibit the qualities of the Swan lamps is not yet ready, but all the other known forms of this class of lamp are in full evidence. The palm is unquestionable carried off by the Edison show, which is extremely beautiful. It is divided into two parts, that in the Concert Room demonstrating the capabilities of the lamps for places of public assembly, and the other portion, in the Entertainment Hall, being more particularly devoted to examples of domestic lighting. In the former, a crystal pendant, thickly sprinkled over with the well-known egg-shaped bulbs containing luminous threads, hangs in the centre of the hall, and festoons of lamps are strung from pillar to pillar round the walls. The light is everything that can be desired. In the other section is a magnificent pendant of wrought and polished brass, of great size, also thickly sprinkled with luminous bulbs, which are artistically adapted to the design of the pendant. As a spectacle this single piece of workmanship is perfectly dazzling, and excites the warm admiration of all beholders. The room also contains a billard-table lighted by the same agency, a smaller pendant, various forms of standards, a row of bulbs showing how they can be applied as stage footlights, and a handsome hall pendant over the door. All these multitudinous lamps are maintained in full power, and give a most brilliant effect."

The same paper in its issue of February 28th, makes the following reference to the Crystal Palace exhibition:

"Without seeking to point a moral to the inspection which takes place at the Crystal Palace to-day, and in respect of which there *may*

possibly be some divergent opinions formed by the members of the Gas Institute and their friends, there is one very prominent feature of the show which can scarcely be overlooked. We do not speak so much in regard to the arc lamps, although the same remark applies to this class, as of the various descriptions of incandescent lamps, when we say that gas engineers may take a lesson from the treatment of their lamps by the electrical engineers. These lamps attract a great deal of attention, and excite much admiration from the general public, for two reasons. In the first place, the quality of the light is excellent, and its steadiness equally remarkable; and, secondly, the appliances whereby it is shown to be adapted to various uses are strikingly beautiful and appropriate to their purpose. The early development of gas lighting, like that of railway travelling, took place at a time when artistic and rational methods of treating new appliances intended to supplant old things were unheard of. Gas fittings were made to imitate candles and oil lamps, and have continued to do so down to the present day. Gas engineers did not, even if they could, instruct gas-fittings manufacturers in the principles by which the best effect could be produced from the gas burnt; and the manufacturers and brassworkers of the time were lamentably deficient in the power of originating true and artistic designs. Thus, partly from the carelessness of individuals and partly from the spirit of the age, gas-fittings became the inefficient and meaningless things which, but for some modern efforts at reform, they would still hopelessly remain. Incandescent electric lighting has dawned upon a widely different period. The progress of art is exuberant even to rankness in some respects; but under all this modern extravagance there is a sense of the necessity of bringing out the fitness of things, to which the handicraftsmen of the past generation were strangers. Hence it is that the incandescent lamp fittings at the Crystal Palace are so effective. Electricians and brassworkers have combined their energies for securing a common object, and the result is equally original and appropriate. We shall not find Mr. Edison attempting to make his luminous threads imitate candles, lamps, or gas-burners; they are treated as they deserve, on their own merits, and they amply repay for the consideration. Therefore this exhibition at least shows that the details of standards and pendants are not held to be beneath the observant care of the engineers who prod[illegible] he light. Gas engineers must take a similar educated interest in all that appertains to gas lighting, in order that the special economical advantages of this system, on which they are always so ready to dilate, shall not be missed through the ignorance and carelessness of gas-fitters and consumers."

The above extracts coming as they do from perphaps the leading Gas Journal of the world, are especially interesting as showing the change of tone in which such journals now speak of the incandescent electric light. The tone is no longer flippant and skeptical but full of thoughtfulness and alarm.

SIXTH BULLETIN.

The Edison Electric Light Company,

65 FIFTH AVENUE.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stock-holders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the Vice President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

New York, March 27th, 1882.

THE EDISON SYSTEM. Mr. Edison is the only inventor in electric lighting, who has a complete *System*. In the case of other inventors, one claims to have a lamp, another a dynamo, another a regulator, and still another all three of these things. But Mr. Edison has gone further, and has perfected not only a dynamo, a regulator and a lamp, but also meters, motors, conductors, underground mains, junction boxes, sockets, chandeliers, brackets, and a large number of other devices, altogether constituting a complete and perfect System of electric lighting. This comprehensiveness and perfection of detail is peculiar to Mr. Edison, and it is this which secured such matchless praise for him from scientists at Paris during the last summer, when high European authorities, like Preece and Du Moncel, who had previously entertained doubts regarding his success, expressed themselves as being converts to "the perfection and completion of the Edison System."

PROFESSOR PREECE ON THE EDISON LIGHT. Professor W. H. Preece, F. R. S. London, has made a special report on the progress of the electric light in England. He says:

"Most of the experiments that have been tried and the installations that have hitherto been made, have been in connection with Arc Lamps, but the results of the experiments and the lessons learned in Paris show unmistakably that the Arc Lamp is only suitable for streets and large spaces; and that for internal purposes, for office work and household purposes, there can be no question whatever that the system by incandescence is that which will eventually supplant gas."

"There are four systems of Incandescent Light now on trial. The Swan; the Lane Fox; the Maxim; and the Edison. I have examined them all with very great care, and I have come to the conclusion that by far the best in all its details is that of Mr. Edison—in fact his system leaves little to be desired."

"A magnificent display of the Edison system has been made at the Crystal Palace. The Concert Room has been illuminated every night for the past fortnight, and has met with nothing but the highest approval. A Central Station has been established on the Holborn Viaduct, and very soon the whole of the Viaduct and every shop and house upon it will be illuminated. The Post Office authorities are going to light up one of their galleries from this centre, and the experiment of distributing the Electric Light on a grand scale is about to be thoroughly started. I have no doubt of its success, and my opinion of the perfection and completion of the Edison system is fully given in the paper read before the Society of Arts."

SIR WILLIAM THOMSON ON HIGH PRESSURE LIGHTS. Sir William Thomson's address as President of the Physical Section of the British Association, contains the following passage: "Nothing above two hundred volts ought on any account ever to be admitted into a house or ship, or other place where safeguards against accident cannot be made absolutely and forever trustworthy against all possibility of accident." This opinion accords with what Mr. Edison has always said, that in the long run every electric light system will fail which does not use a low-pressure current; and it explains why he worked from the start to perfect such a system. His quickest and

easiest way was to do what others did, namely, adopt a high-pressure, regardless of the danger of life and of fire involved in it. Mr. Edison, however, did in this respect what he has done as regards all the other peculiarities of his System—he absolutely perfected it, so as to make it safe and economical, before endeavoring to introduce it into public use. Consequently, we use a low-pressure current of only about 100 volts, while all other lights require a high pressure, even as high sometimes as 2,400 volts. This enormous difference means absolute safety in the one case, and actual death in the other, if the wires are touched. Accidents from high pressure currents continually occur. For instance, last week a man in Denver, when about to connect the circuit-wires of a certain arc light, was completely paralyzed; and recently an employee of the Cleveland Rolling Mill Co., was instantly killed by coming in contact with the wires of the same arc light company. Mr. Edison's foresight and thoroughness save us from such terrible experiences. Our light is now burning all over the world, from Finland to Chili—usually in the hands of unskilled men, utterly ignorant of electrical matters—yet we have never had a fire or an accident.

EDISON LIGHT IN CHILI. The principal hotel and surrounding grounds, at Vina Del Mar, seven miles from Valparaiso, has been lighted since January 29th, with an Edison isolated plant. This town is located on the coast, and besides being a place of popular resort for wealthy Chilians, is also the residence of many of the leading business men of Valparaiso. Prior to the introduction of this plant, the lighting had been done by means of gas and kerosene. The plant is giving perfect satisfaction both indoors and out. The illumination in the grounds and gardens about the hotel, where the Edison light is exclusively used, is unusually beautiful and satisfactory.

METERS FOR THE FIRST NEW YORK STATION. The Edison Electric Meter, for measuring the current of electricity sold to consumers, the same as gas is measured by the thousand feet, is working successfully. A large number are now being made for the Pearl Street Station. Twenty 20 light meters and five 50 lights meters have recently been shipped to London to be used in connection with the small central station plant installed on the Holborn Viaduct. The meters are entirely reliable, in fact they may be said to be absolutely accurate, being vastly superior in accuracy to the best existing gas meters.

RAILWAY STATION LIGHTED AT RIO. The Don Pedro railway station at Rio de Janeiro, Brazil, is now lighted with an Edison isolated plant. The lamps are distributed to light the platform, waiting rooms, Directors' room and the entrance. The Directors and others connected with the railway company are well pleased. A commission has been appointed by the Engineer's Club of Rio to report upon the light. We have received a copy of the principal newspaper of Rio, calling attention to the display of the light as being made at the railway station under the superintendence of the Chief of the Railway Telegraph Department, and expressing complete satisfaction with it. The Minister of Public Works was expected to make a visit of inspection the succeeding week.

EDISON LIGHT IN FINLAND. The following cablegram relative to the Edison isolated plants just started in the factories at Tammerfors, Finland, was received March 17th: "Light installed in latitude 61. Perfect success."

DANGER FROM GAS. The gas house of the Wilkes-Barre Gas Company was demolished by a gas explosion, March 6th. The Wilkes-Barre *Record* states that "some of the timbers flew high in the air and fell on all sides, the canal was nearly filled with slate and woodwork, doors and windows in houses near by were broken, a passing buggy had a wheel taken off, a man passing by was thrown to the ground and stunned, five workmen were prostrated, and had any employees been in the part torn down, they would certainly have been killed." The explosion left the city entirely without gas, pending repairs. * * * A recent gas explosion in the Union Building, Chicago, knocked out heavy plate glass from windows in all parts of the building, and wood-work, doors and plastering were demolished. A boy, James Brett, was seriously if not fatally injured. * * * R. H. Stryker was recently found dead in his room at the Bridge Hotel, Chatham Street, New York, killed by the escape of gas, which he had blown out instead of turning off. * * * Another man, F. W. Hoffman, was lately found dead in his bed at the North River Hotel, in Barclay Street, with the gas turned on. * * * A distinguished American authority on nervous diseases, in an article entitled, "How to Escape Nervousness," in a recent number of *Our Continent*, speaks of gas as follows:

> "A gas-burner consuming four cubic feet of gas per hour, produces more carbonic acid in a given time than is evolved from the respiration of eight adult human beings. Bear this in mind, you who suffer from nervousness, that when you have shut yourselves up in your rooms and lighted an argand burner (which consumes about twelve cubic feet of gas per hour), you are to all intents and purposes immured with twenty three other persons all taking oxygen from the atmosphere. Is it a wonder that after several hours exposure to such depraved air, your nerves should rebel as far as their weak state permits, and that your head should ache, your hands tremble, and that your daughter's playing on the piano almost drives you wild?"

EDISON'S PATENTS. Ninety-three patents for electric lighting have already been allowed Mr. Edison in the the United States. Of this number eighty-one have been already taken out and assign-

ed by him to this Company. Besides these, he has filed applications for one hundred and one additional patents, which are being regularly acted upon in due course of proceeding at the Patent Office. These patents cover the following details of the Edison System, viz: Dynamos, the preparation and manufacture of carbons and their treatment after manufacture, carbonizers, underground conductors, safety wires for conductors, motors and appliances therefor, sub-division, vacuum apparatus, vebermeters, storage of electricity, lamps including carbons, designs for lamps, designs for fittings and fixtures, manufacture of lamps, the sealing of lamps, thumb screws for turning the current on and off, sockets, and devices against fire and personal danger.

The following is a list of the first 81 patents for electric lighting, issued to Mr. Edison in the United States, with the number, date and title of each.

NUMBER.	DATE.			TITLE OF PATENT.
214,636	April	22,	1879	Improvement in Electric Lights.
214,637	"	22,	"	" " Thermal Regulators.
218,166	August	5,	"	" " Magneto-electric Machines.
218,167	"	5,	"	" " Apparatus for Electric Lights
218,866	"	26,	"	" " Electric Lighting Apparatus.
219,393	Sept.	9,	"	" " Dynamo-electric Machines.
219,628	"	16,	"	" " Electric Lights.
222,881	Dec.	23,	"	" " Magneto-electric Machines.
223,898	Jan.	27,	1880	Electric Lamp.
224,329	Feb.	10,	"	Electric Lighting Apparatus.
227,226	May	4,	"	Safety-conductor for Electric Lights.
227,227	May	4,	1880	Electric Light.
227,228	"	4,	"	" "
227,229	"	4,	"	" "
228,617	June	8,	"	Brake for Electro-magnetic Motors
230,255	July	20,	"	Method of Manufacturing Electric Lamps.

NUMBER.	DATE.			TITLE OF PATENT.
237,732	Feb.	15,	1881	Electric Light.
238,868	March	15,	"	Manufacture of Carbons. Incandescent Lamps.
239,147	"	22,	"	System of Electric Lighting.
239,148	"	22,	"	Treating Carbons for Electric Lamps.
239,149	"	22,	"	Incandescing Electric Lamp.
239,150	"	22,	"	Electric Lamp.
239,151	"	22,	"	Method of Forming Enlarged Ends on Carbon Filaments.
239,152	"	22,	"	System of Electric Lighting.
239,153	"	22,	"	Electric Lamp.
239,372	"	29,	"	Testing Electric Light Carbons.
239,373	"	29,	"	Electric Lamp.
239,374	"	29,	"	Regulating the Generation of Electric Currents.
239,745	April	5,	"	Electric Lamp.
240,678	"	26,	"	Webermeter.
242,896	June	14,	"	Incandescent Electric Lamp.
242,897	"	14,	"	" " "
242,898	"	14,	"	Magneto or Dynamo-electric Machine.
242,899	"	14,	"	Electric Lighting.
242,900	"	14,	"	Manufacturing Carbons for Electric Lamps.
242,901	"	14,	"	Electric Meter.
248,416	Oct.	18,	"	Manufacture of Carbons for Electric Lamps.
248,417	"	18,	"	Manufacturing " " " "
248,418	"	18,	"	Electric Lamp.
248,419	"	18,	"	Electric Lamp.
248,420	"	18,	"	Fixture and Attachment for Electric Lamp.
248,421	"	18,	"	Current Regulator for Dynamo-electric Machines.
248,422	"	18,	"	System of Electric Lighting.
248,423	"	18,	"	Carbonizer.
248,424	"	18,	"	Fitting and Fixture for Electric Lamps.
248,425	"	18,	"	Apparatus for Producing High Vacuums.
248,426	"	18,	"	Apparatus for Treating Carbons.
248,427	"	18,	"	Apparatus for Treating Carbons.

NUMBER.	DATE.			TITLE OF PATENT
248,428	Oct.	18,	1881	Manufacture of Incandescent Electric Lamps.
248,429	"	18,	"	Electric Motor.
248,430	"	18,	"	Electro Magnetic Brake.
248,433	"	18,	"	Vacuum Apparatus.
248,434	"	18,	"	Governor for Electric Engines.
248,435	"	18,	"	Utilizing Electricity as a Motive Power.
248,436	"	18,	"	Depositing Cell for Plating the Connections of Electric Lamps.
248,437	"	18,	"	Apparatus for Treating Carbons.
251,536	Dec.	27,	"	Vacuum Pump.
251,537	"	27,	"	Dynamo-electric Machine.
251,538	"	27,	"	Electric Light.
251,539	"	27,	"	Electric Lamp.
251,540	"	27,	"	Carbon for Electric Lamps.
251,541	"	27,	"	Electro Magnetic Motor.
251,542	"	27,	"	System of Electric Lighting.
251,543	"	27,	"	Electric Lamp.
251,544	"	27,	"	Manufacture of Electric Lamps.
251,545	"	27,	"	Electric Meter.
251,546	"	27,	"	Electric Lamps.
251,547	"	27,	"	Electric Governor.
251,548	"	27,	"	Incandescent Electric Lamp.
251,549	"	27,	"	Electric Lamp and the Manufacture thereof.
251,550	"	27,	"	Magneto or Dynamo-electric Machine.
251,551	"	27,	"	System of Electric Lighting.
251,552	"	27,	"	Underground Conductor.
251,553	"	27,	"	Electric Chandelier.
251,554	"	27,	"	Electric Lamp and Socket.
251,555	"	27,	"	Regulator for Dynamo-electric Machine.
251,556	"	27,	"	Regulator for Dynamo-electric Machine.
251,557	"	27,	"	Webermeter.
251,558	"	27,	"	"
251,559	"	27,	"	Electrical Drop-light.
12,631	"	27,	"	Design for an Incandescent Electric Lamp.

SEVENTH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the Vice President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

NEW YORK, April 17th, 1882.

THE FIRST DISTRICT IN NEW YORK CITY. The installation of the First District in this city is almost completed. The district is nearly a square mile in extent, being bounded on the East by the East River, on the South by Wall St., on the West by Nassau St., and on the North by Spruce St., Ferry St., and Peck Slip. The buildings purchased by the Company to be used as a central station to generate the electric current to be distributed over the district by means of underground cables, are located at at Nos. 255 and 257 Pearl St., a little South of Fulton St. For the present only one of these buildings, the one at No. 257 Pearl St. is being fully equipped. The preparation of this district for lighting has involved a vast amount of work, which, generally speaking, may be divided into four branches, namely, the structure or the preparation of the building for the reception and maintenance of the plant, the manufacture and installation of the engines, dynamos and other electrical

apparatus, the manufacture and laying of the underground conductors, and the wiring of houses. The work on the first of these items, to wit, the central station structure, includes the masonry foundation and concrete, a two story iron frame work, vaults under the side walk and streets, four boilers with an aggregate capacity of [illegible],000 horse power, boiler fittings, two smoke stacks (each 5 feet in diameter and 80 feet high), steam conveyers for coal and ashes, shafting, blowers, and the pumping and blowing apparatus. The above work is all finished, and the hoists and ventilating apparatus, also belonging to the central station structure, alone remain to put in. The station equipment consists of six engines, six dynamos, and the resistance and regulators. The engines have been built by the Southwark Foundry and Machine Company, Philadelphia, and delivered to us. There are six of them, each having a normal capacity of 125 horse power, and a maximum capacity of 200 horse power, making a total maximum capacity of 1,200 horse power. The six dynamos, being built at the Edison Machine Works, Goerck St., New York City, are approaching completion. The resistance and regulator apparatus is also nearly completed. The weight of each of these six steam dynamos is thirty tons, making the aggregate weight of the six dynamos, 180 tons. The weight of the entire structure and electrical apparatus, at No. 257 Pearl St. alone, will be about 500,000 lbs., that is to say about 250 short tons, and this weight will be distributed so as to average only about 200 pounds per square foot of structure. The boilers in this one building, when under full headway, will consume 1,680 tons of coal and 4,200,000 gallons of water per annum, equivalent to a daily consumption of about five tons of coal and 11,500 gallons of water. As regards the underground conductors, work is being pushed as rapidly as possible. Prior to March 1st, 1882, 39,403 feet of the underground mains had been laid. In the month of March, 15,898 feet more were laid. In that month there were 27 working

days and 4 Sundays, but, owing to the loss of 5 days from rain and 2 from other causes, we worked only 20 days and one night, the average feet laid per day during the month being 588, the average for the days which we actually worked being 795, the least amount laid in any one day being 423, and the largest amount laid in any one day being 1,246 feet. There yet remains to be laid something over 18,000 feet of the mains, besides bridges and connections at street intersections, which, it should be stated, will take a much longer time, per foot, than the regular mains. Regarding the wiring of houses, they were finished early in February. We have completely wired 107 places in Beekman St., 166 in Fulton St., 75 in John St., 78 in Maiden Lane, 97 in William St., 46 in Front St., 68 in Nassau St., 43 in Pearl St., 36 in Cedar St., 28 in Pine St., 24 in South St., 31 in Ann St., 12 in Spruce St. and enough more in other streets to make a total of 946 places wired. The number of lamps arranged for in the places thus wired is 7,916 A (16 candle) lamps, and 6,395 B (8 candle) lamps, making a total of 14,311 lamps. The lamps themselves were made months ago and are now in store ready for use. The central station will supply electric current not only to illumine these and additional lamps, but also to run motors for elevators, hoistways, printing presses, and machinery of all kinds. From all that is stated above, it will be seen that little now remains to be done, except to finish the laying of the underground conductors, before the First District will be entirely completed, and the lighting-up commenced.

UNDERGROUND CONDUCTORS IN HARTFORD. The *Hartford Times* of March 15th, contains a report of a Joint Committee of the Board of Aldermen and the Street Commissioners, made to the Board of Aldermen, on the subject of Underground Electric Conductors. The following extract contains the substance of their report:

"Your committee are extremely averse to the erection of poles and posts in the streets, especially for the purpose of suspending electric wires, if it can be avoided without too great expense. In regard to this, the petitioners claim that no plan has yet been devised for conveying electricity under ground, excepting at a great expense of power. The explanation which your committee have been able to obtain is not in harmony with this claim. The Edison company are now covering a district in New York city, one mile square, with their electric conductors laid in iron tubes under ground, and claim from experiments on miles of these tubes, to have demonstrated that there is no material loss of electric force, even in comparison with the wires above ground. Now, if the claim of the Edison company that electricity can be conducted in these small tubes at an expense not materially greater (except in the original outlay) than on wires in the open air, then the posts and poles ought not to be set up in our streets; nor the very considerable danger arising from the wires unnecessarily incurred. The fact of the matter will be very soon determined in New York—another reason against undue haste. If, on the whole, it should appear best to permit the experiment in any form, we think the council or the board of street commissioners should retain full control of every detail of the arrangements, and that everything done should be subject to approval and revocation. All crude experiments should be avoided, and the best system should be adopted, even if it be not the cheapest in the original construction."

The report was accepted by the Common Council, March 13th, and the use of the streets for poles, was refused.

CANADIAN COMPANY. The *House of Commons Debates*, Ottawa, March 20th, contains the debate on the bill incorporating the Edison Electric Light Company of Canada. At the close of the debate the bill incorporating the Company was passed by the Lower House. It now goes before the Upper House.

PLANTS IN CHICAGO. We are installing an isolated plant in the Palmer House, to light the dining-rooms. * * * The plant in the store of Rand, McNally & Co., gives great satisfaction. They say that if they should take the plant out and use gas again, their men would insist upon having our light put back. They find the light of great use in mixing colored inks, which cannot be successfully done by gaslight. * * * Mr. John V. Farwell, has ordered two isolated plants for the Republic Insurance Building.

MINIATURE CENTRAL STATION AT FALL RIVER. One of our small plants, now installed in Fall River, is lighting several stores, a telegraph office, and the rooms of a club, the same being located in two different blocks. The places lighted are as follows, namely, Bruneau's jewelry store, Sargent's dry goods store (both in Granite Block), Boone's tailoring establishment, Trafton and Anthony's hardware store, L. D. Wilbur and Co's ready made clothing establishment, the Western Union Telegraph Office, two entrances to the Academy of Music, and the corridor and the Commercial Club rooms in Borden Block. There are all told, 120 A lamps and 6 B lamps, and the dynamos are located about four hundred feet away from the lamps. Regarding this plant, Mr. Spencer Borden, in a report from Fall River dated April 4th, writes as follows:

"Last night we completed the first 150 hours of running our small station in Fall River. Everyone using the light is high in its praise, as a superior light to gas. Mr. Boone says he gets three times the light he did with gas, and that it is entirely free from any of the disadvantages gas has. Most of these stores remain open until 10 P. M. L. D. Wilbur and Co., who had thirty gas lights (replaced by twenty-seven of ours), tell me that before the hour of closing, their gas used to make their store suffocating, both because of the heat and the bad air. They say they do not see how they stood gas so long, and that they never will let our electric light leave them if they can help it. The testimony of the others is uniformly the same. The Manager of the Western Union is especially loud in praise of the Edison Light; and Bruneau says so much in its favor that he has been asked, as a joke, what he was paid for advertising it. In the Club Rooms it is greatly admired, especially in the reading rooms. You, who know the cost of running the station, need no assurance that the light is economical—much less than one half the cost of gas to light the same spaces, and far less than any other method of good artificial lighting. We also have here had an opportunity to test the life of the lamps. Calling the circuit 120, instead of 127 lamps, the average of 600 hours for which you guarantee the lamp, would allow 30 to be broken in 150 hours, if not raised to an incandescence exceeding 16 candle power. Our lamps, however, are actually burned at a higher incandescence than this—as high as from 20 to 25 candle power. Yet we have broken only seven lamps, two of which were in the same fixture, fastened to the same frame as the door in Sargent's store, and I strongly suspect the slamming of the door had something to do with the breakage. Still, calling these worn out by the current, the average is very low. The apparatus is running to perfection, the dynamos being perfectly balanced, and entirely free

from sparks at the commutators. The engine has been indicated and shows $17\frac{1}{10}$ horse power, which gives about $7\frac{2}{10}$ lamps to the horse power applied in the cylinder. When it is considered that this includes the friction of all parts of the engine and dynamos, it is safe to assert that the dynamos are supplying fully 8 lamps of 20 candle power incandescence, for every horse power they receive from the belts. Our apparatus has been visited and inspected by numbers of people, both manufacturers of Fall River, and parties from other cities, and wins high encomiums from all. It is in charge of an intelligent Yankee boy of 20 years, who has no difficulty in keeping it in good adjustment and perfect operation. This little station, where everyone sees it and has to see it, is doing wonders in the friends it is making for the Edison Light."

PROGRESS IN EUROPE. Two isolated plants are running at Frankfort, and one at Hamburg. Our light has also been shown on railway trains at Frankfort with great success; also at Stuttgart. The illumination of a portion of the Strasburg depot is a great success, and negotiations are pending for lighting the entire station. At Milan, the Scala Theatre has been lighted up for nearly two months, also a street in the city, and now the "Caffe Biffi" is lighted with one of our plants. The Milan papers, the *Lombardia* and the *Perseveranza*, both of March 23rd, speak very flatteringly of the lighting up of this Caffe. Installations are about being made in Rome and Ferrara. A large factory in Styria is just being lighted. Local companies are in process of formation for most of the countries of Europe, the details of which will be given in future numbers of the Bulletin.

EDISON'S ELECTRIC RAILWAY. April 7th, Prof. Geo. F. Barker, of Philadelphia, and Prof. Henry Draper, of New York City, visited Menlo Park, with Mr. Edison, to ride upon the electric railway. The trip was very satisfactory. At present the road is only equipped for passenger traffic, but a freight engine and freight cars are now being built to practically test the economy of carrying heavy freight trains over an electric railway.

EDISON'S FIRE PROTECTOR. The *Electrician*, London, March 4th, contains large illustrations of Edison's Fusible Conductors, and describes them as follows:

"An important part of Mr. Edison's arrangement is that which provides against fire. It can be easily understood how from some unforseen cause a current might be sent into a main stronger than the main was assigned to carry. This strong current would heat the wires and possibly cause serious mischief. To guard against such mischance, Mr. Edison inserts a metallic fusible connection between his conductors, which fuses under a certain current. This fusion current is, of course, somewhat greater than that which the conductor is designed to carry, and less than that which would raise the conductor to a dangerous temperature."

STEAMSHIPS TO BE LIGHTED. We are wiring at Cramp's shipyard, Philadelphia, the steamship Queen of the Pacific, belonging to the Oregon Railway and Navigation Company. This order is in consequence of the success of one of our plants on the Columbia, another steamship belonging to the same Company, and lighted with the Edison light. * * * We are also wiring Mr. James Gordon Bennett's steam yacht now being built at Ward, Stanton and Co's shipyard, Newburgh.

UNDERGROUND CONDUCTORS IN RHODE ISLAND. The *Providence Journal* of March 15th, contains a report of a continued hearing before the Senate Judiciary Committee of Rhode Island, on the question of compelling electric light companies to place all their conductors under ground in the State of Rhode Island. The following extract, taken from a published report of the proceedings, recites interesting facts:

"Both in London and in Paris, electric light wires are not allowed overhead for more than temporary purposes. In London the sub-ways on all the large streets average four feet in height, and the wires are there fastened to the walls of these sub-ways. Through the sub-ways also run the gas and water mains. The sub-ways are dry, being distinct from the drains; consequently, the advantages of non-exposure of the electric wires to wind and wea-

ther are obvious. This is the same way in Paris. In both cities it is very difficult to get permission to put wires overhead. In London, all telegraph and street wires are under government control, and it is nearly impossible to run wires overhead. In Berlin, where all wires—telegraph, telephone and electric light—have now to be put underground, the two former are run on the opposite side of the street to the latter, and all crossings are made at right angles or obtuse angles to avoid inductive effects. Electric wires in Paris, carrying five or even six lamps, have been run under ground for some two years now, and without much trouble."

PHILADELPHIA LEDGER. We have received an order from the *Philadelphia Ledger* for one of our isolated plants to light the compositors room. It will be installed at once.

UNAUTHORIZED USE OF MR. EDISON'S NAME. Occasionally an advertiser, wishing to catch the public eye, uses the name of Edison, but does it in such a manner as not to transgress the strict letter of the law. Thus the public are imposed upon and Mr. Edison is powerless. One of the latest cases of this kind is the publication of a newspaper in Philadelphia called *Edison's Review*, which purports to be published by the Edison Music Company. A sketch of Mr. Edison's life, and a cut of the lamp, both prominently displayed on the first page, together with several references to his inventions, make the publication look as if it had some connection with him. Mr. Edison will take legal steps to suppress this publication if possible. But ordinarily, the use of his name by advertisers, is managed so adroitly as to afford no adequate ground for legal proceedings.

PLANT AT STILLWATER, MINN. Mr. Roney, foreman in charge of that part of the works of Seymour, Sabin & Co. Stillwater, wherein one of our isolated plants is installed, states in a recent letter that "the dynamos are running splendidly, day and night, and the same brushes are being used that were put on at the start, and

they seem as good as new." This plant consist of two Z dynamos running 280 B (eight candle) lamps, thirty of which are in the residence of Mr. Sabin, one thousand feet distant from the works. The dynamos were started December 24th.

DANGER FROM GAS. The gas house of the Westchester Gas Company, Yonkers, exploded recently. The *American Gas Light Journal* says: "The building was a mass of ruins, the front and north walls were entirely blown out, the other walls were in an unsafe condition, and the iron roof was twisted in all sorts of shapes." The cause of the explosion was owing to an escape of gas through a pipe in which there was a cock which was supposed to be shut. * * * Another recent explosion at Yonkers took place in the store of A. Sahaigan, caused from the sewer in the street being filled with gas, emanating from leaky mains, and the gas finding its way from the sewer through the soil pipe. * * * Two young girls were recently found dead in their bed at 599 Third Avenue, New York. There were two gas jets in the room and probably both jets had been turned on in the darkness and only one had been lighted. The escape of gas from the other jet caused the deaths. * * * Last October, fifteen employees in a room in the silk factory of Copcutt & Co., Yonkers, were prostrated by the escape of gas. One employee, Mrs. Kilgour, remained for some time in a critical condition; one went into convulsions; another, Miss Birch, was taken home insensible and for some time doubts were entertained of her recovery; while the others were similarily though not so seriously affected. * * * Wells Brainard, of Gainsville, recently died from asphyxia, the result of blowing out the gas upon retiring, at the Clinton Hotel, Rochester. * * * The records of the New York Coroner's office show that gas suffocation has caused eleven deaths in New York City within the last two years. * * * An explosion took place at the Opera Comique, Paris,

March 11th, caused by gas leakage, and, according to *Le Petit Journal*, there would have been an immense conflagration, had it not been for the courage of the firemen and police. * * * Mr. Rhodes, the foreman of the Grand Jury, states with reference to the recent burning of the New York *World* building, that it was the unanimous opinion of the jury that the fire was caused by a leakage of gas. * * * The following is an extract from the New York *Evening Post*, March 27th.

"The gas suddenly went out all over the city of Kingstown, Ontario, on Saturday night, while a performance of "Patience" was being given in the Opera House. The management, as soon as they recovered from their astonishment, lighted up the stage with candles and lamps, and the players went through with the rest of the opera with lighted candles in their hands."

CRYSTAL PALACE EXHIBITION AGAIN. There are 854 Edison lamps burning in the Crystal Palace. They are arranged as follows: Concert Room, 380 lamps, Entertainment Court, 200, Industrial Booths, 84, Central Transept, 48, Railway Station Entrance, 47, Domestic Company, 80, and Dynamo Room, 15. These lamps are run by twelve small Edison Dynamos, on the floor below, so arranged that any of the dynamos may be thrown out of circuit without affecting the light. The current is carried from the dynamos to the lamps by a single conductor. Every circuit is supplied with a switch for throwing the lights on or off at pleasure, and every branch and sub-branch is supplied with a safety-plug or protector, for automatically opening the circuit in case of accident. No accident, however, of any character has taken place. The Concert Room (lighted by 380 lamps) is occupied nightly with various entertainments, and is frequently crowded throughout. It is large and difficult to light, but our light is pronounced perfect by all. Recently, at an illustrated lecture, in that room, nearly one half the lamps were thrown on and off at the tap of a bell by the lecturer, without in the least affecting the remaining lights. The Edison light is the only

one in the exhibition which has not at some time since the opening gone out and left the exhibit in darkness. The Edison exhibit has been visited by the Duke of Edinburgh and party, twice by the Duke of Westminster, twice by the Duke of Sutherland, also by the Chairman and Board of Directors of the Midland Railway Co., by the Gas Institute (numbering 300), and by innumerable delegations from cities, boroughs &c., Mr. Johnson is also under engagement to give private exhibitions of the Edison System t. the Society of Arts, the Royal Society, and many other important bodies.

The following is from the London *Nature* of March 9th:

"The centre of attraction at the exhibition of electricity in the Crystal Palace, formally opened on Saturday by the Duke and Duchess of Edinburgh, will unquestionably be the show of Mr. Edison. His electric light in the Entertainment Court and the Concert Room is by far the finest ever yet made, and is of itself a spectacle to be remembered. No expense has been spared to demonstrate the power and beauty of his incandescent lamps, and the divisibility of the current to meet the wants of domestic lighting; while Messrs. Verity and Sons have seized the occasion to illustrate their skill and show how eminently adapted the electric light is for ornamental purposes. But in addition to its superiority over gas, oil, and candles in these respects, the Edison exhibit also proves in the most striking manner its superiority as a decorative light, and its unrivalled capacities for enhancing the artistic pleasures of our homes. Besides giving off no deleterious gases to tarnish gilding or dim the most delicate colours, the incandescent lamp lends itself to the designer's fancies in a way which no other illuminant can; and we may expect something like a revolution in household decoration by its introduction, as well as a new development of the brass-worker and the glass-blower's art."

* * * "Mr. Edison saw the merits of the incandescent system for domestic lighting at a time when other electricians were giving all their attention to the arc light; and therein showed his genius and foresight. For it is evident now to electricians that while the arc light is well enough adapted for the lighting of large areas it is unsuitable for small interiors."

The *Metropolitan*, London, March 11th, gives the following report about a suite of rooms at the Crystal Palace, illumined by the Edison light, and meant to show the especial adaptability of that light to domestic purposes:

"The suite consisted of five rooms, and for the purposes of the lighting Mr. Edison's lamps were employed. The arrangement, decoration, and furn-

ishing of the entrance morning room had been carried out by Messrs. Wm. Watt and Co. The smoking room, fitted up in Japanese style, had been entrusted to Messrs. Liberty and Co.; while the dining room has been designed, decorated, and furnished by Messrs. Bertram and Son; the appointments of the dining-table having been supplied by Messrs. Philips and Pearce. The decorations and furniture of the drawing-room and boudoir had been designed and executed by Messrs. H. and J. Cooper; and the whole of the embroideries had been supplied by the Royal School of Art Needlework. The fittings for the lamps, together with the girandoles and electroliers had been specially prepared for this Exhibition by Messrs. Benjamin Verity and Sons. The lighting proved most effective, and was much admired by those present. There was an entire absence of all glare, but the lighting was everywhere adequate, the lamps in the drawing-room being fitted with small shades, which rendered the effect pleasing in the extreme. In the dining-room the illumination was appropriately brilliant, while in the smoking-room it was more subdued. The apartment however, which attracted most was the boudoir."

The *Engineering*, London, March 17th, contains a long and illustrated account of the Edison exhibition in the Crystal Palace. It says:

"Of all the electric lighting systems represented at the Crystal Palace, the the most complete and important installation is that of Mr. Edison, or, more correctly speaking, of the Edison Electric Light Company, and the whole of the exhibits of that enterprising body, whether it be the very striking and effective distribution of incandescence lamps in the Entertainment Court and Concert Room or in the splendidly worked out installation of the engines and generators at the principal garden entrance, is distinguished for its thoroughness and sound practical character, and we think it is not too much to say that this is acknowledged by competing exhibitors as much as by more disinterested visitors." * * * "From the beautifully simple and well arranged system for making the connections and regulating the current to the work it has to do, it must be commended as the most thoroughly well arranged, and well carried out mechanical installation in the Exhibition."

The article then concludes as follows:

"The Edison installation at the Crystal Palace cannot fail to give to the Exhibition of 1882, a distinctive feature of interest, and one by which it will long be remembered; for, whether it be regarded from an electrical or from a mechanical point of view, or as an example of highly efficient and decorative illumination, it is quite unsurpassed by anything that has preceded it, and reflects the highest credit upon the Edison Electric Light Company and upon everybody who has been connected with the installation."

EIGHTH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the Vice President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

NEW YORK, April 27th, 1882.

PROGRESS IN THE FIRST DISTRICT, NEW YORK CITY.

In the last Bulletin a detailed statement was made of the progress made up to that time in the First District in New York City. Since then additional street mains have been laid, and it is hoped that if good weather continues the most of the street mains will have been put underground by the end of this month. Nothing will then remain to be done as regards the underground conductors except to put in the bridges and connections at street intersections. Three of the six mammoth steam dynamos have been already assembled at Goerck Street and the other three will be set up as soon as the first three are out of the way. A five hour test on one of these dynamos was made last Thursday night with good results, and that dynamo is now being removed from the Goerck Street shops to the Pearl Street Station. A more detailed statement of the progress being made this month will be published in the next Bulletin.

THE EDISON LIGHT IN ALBANY. The following extract is taken from the *Albany Journal*, April 19th:

"The agent of the Edison Electric Light Company is in town making arrangements for the introduction of the Edison incandescent electric lights in the new banking house of Spencer, Trask & Co., on the corner of State and James streets. These lights differ materially from the Brush arc lights which are used in the street lighting. The lights, which are sixteen candle power, are attached to chandeliers or brackets, and can be lighted or extinguished singly, as in the case of gas. It is expected that a public exhibition will be given on Saturday or on Monday evening and if the experiment proves satisfactory a company will probably be formed in the city for the general introduction of this system of illuminating."

WIRING IN CHICAGO. We are wiring for the Edison Light the new residences of J. W. Doane, O. R. Keith and H. H. Porter.

UNDERGROUND CONDUCTORS IN RHODE ISLAND. The Senate Judiciary Committee of the Rhode Island Legislature has finished its hearings on the question of compelling electric light companies to place their conductors under the ground, in Rhode Island. These hearings have been spoken of in the Fourth and Seventh Bulletins. The report of the Committee and the bill prepared by them have been laid before the Senate. The Providence *Journal*, April 22nd., prints the bill in its report of the proceedings of the General Assembly of April 21st. It says:

"Senator BOURNE, from the Judiciary Committee, called from the table the act relative to the laying of wires for conducting electricity, with recommendation that the substitute bill pass. The substitute is as follows:

SECTION 1. No person shall erect or maintain through or across any highway above the surface of the ground, or across the property of another without the consent of the owners thereof, any wire which shall be used to conduct a current of electricity for electric lights, or for furnishing power, or which shall be used to conduct a current of electricity, the electromotive force of which shall exceed 200 volts.

SECTION 2. Every person who shall violate any of the provisions of the preceding section shall be fined not exceeding $1,000, or imprisoned not exceeding three months, for each offence; and shall be fined not exceeding $50

for each day's continuance of the said violation after the service of the warrant issued upon the first complaint.

SECTION 3. The Supreme Court may by injunction restrain every violation of this act.

SECTION 4. Every wire erected or maintained contrary to the provisions of this chapter, is hereby declared to be a public nuisance.

SECTION 5. Town Councils and City Councils may pass such ordinances, by-laws and regulations in relation to the placing, insulating and use of the wires referred to in section 1 of this act, as they may judge the public safety requires, and may prescribe penalties for the violation thereof, not exceeding one hundred dollars for any one offence.

Accompanying the bill was a full and exhaustive report from the committee, which was received and ordered printed.

The bill was taken up, and after discussion by Senators BOURNE, ARNOLD and WILBUR, from the committee recommending its passage, and by Senators DYER and RAZEE, urging its continuance to the May session, it was passed and ordered communicated to the House."

The Lower House received the above Bill from the Senate on April 22nd, and at once referred it to the Judiciary Committee.

TESTIMONIAL TO THE EDISON LIGHT. Mr. W. P. Potter, the Manager of the Western Union Telegraph Company at Fall River, pays the following tribute to the Edison Light in use in his office: "It is by far the best light I ever saw to work under. It is perfectly steady, has a softness that no other light has, and I have no hesitation in saying I believe it has no equal."

PROGRESS IN EUROPE. Pending the completion of factories abroad for manufacturing plants, machines are procured from the Edison Machine Works in this city, where an order has just been received from Paris for eight 250—light machines and four steam dynamos of 1,200 lights each.

EDISON'S ELECTRIC RAILWAY. Below is an extract from a recent number of the *New York Review of the Telegraph and Telephone*.

"Several miles of Mr. Edison's electric railway at Menlo Park are now completed, and a few days ago the pupils of Professor A. E. Sloan's school, of Bergen Point, N. J., about thirty in number, were carried over this road by electricity at the rate of over twenty miles per hour. At the experiments in Berlin last year, on nine miles of the Siemens road, the speed attained was only about ten miles per hour. Mr. Edison's track is like that of any ordinary railroad, involving curves, grades (one over thirty feet to the mile), with the various obstacles of ravines, streams and rocks. The car resembles our modern horse-car. The electricity is communicated from the generators, some 300 yards away, by two heavy wires, one connecting with each track. The tracks are insulated by covering the ends of the ties with a nonconducting compound. The wheels take up the electricity from the tracks and communicate with the dynamo-electric machine and gearing in the locomotive. Thus is given to the train a noiseless, rapid, pleasant motion, unattended with smoke, cinders and clatter."

WAMSUTTA MILLS, NEW BEDFORD. The plant of 60 lights heretofore installed in the Wamsutta Mills has given such satisfaction that an order has just been given us to light their new "No. 6" mill, just being completed. The building is 820 feet long, about 100 feet wide, and three stories high, and will require about 650 lamps of 16 candle power each. In the weaving room one lamp will light four looms. Our orders are to have the plant installed in time to have the light started when the mill is completed.

FORMATION OF THE EDISON COMPANY FOR GREAT BRITAIN. The London *Electrical Review*, March 25th, contains the following report of the formation of the Edison Electric Light Company, Limited, in London, to take title to Mr. Edison's patents for the United Kingdom of Great Britain and Ireland:

"The Capital £1,000,000 is divided into 50,000 A, or £5 per cent. preference shares, and 50,000 B shares of £10 each. Objects: To acquire the whole of the letters patent for the United Kingdom taken out by Thomas Alva Edison in relation to electricity or magnetism as a lighting, heating, or motive agent, together with the electric lamps, dynamo and other plant of Mr. Edison now in England, and capable of being used in exhibiting the patents, or in the production of electric light; and also to acquire the lease of No. 57 Holborn Viaduct. The purchase consideration is a sum in cash not

exceeding £30,000, and the allotment of one fully paid B share for each £10 of capital paid up, or credited as paid up, in respect of the A shares. Signatories (with 500 shares each): Right Hon. E. Pleydell Bouverie, 44 Wilton Crescent; Sir John Lubbock, Bart., M. P., High Elms, Down, Kent; Howard Gilliat, 4 Crosby Square, E. C.; W. G. Rathbone, 2 Fenchurch Avenue; W. Fowler, M. P., 38 Grosvenor Square; Sir F. J. Bramwell, 37 Great George Street, S. W.; E. Hibberd Johnson, 57 Holborn Viaduct. Directing qualification: 500 shares. Remuneration: £500 per annum to the chairman, and £200 per annum in respect of each director. Viscount Anson, Shelford Bidwell, and Richard Blaney Wade, are also directors. Registered office, 57 Holborn Viaduct. Registered 15th inst. by Waterhouse and Winterbotham, 1 New Court, Lincoln's Inn."

Mr. Johnson writes that the Board of Directors of this Company meet at their office in London every week and sit for from three to four hours, and that they also meet informally for conference two or three times a week in addition.

AMERICAN ELECTRIC LIGHT CO. The Boston and New York papers have recorded the demise of this company in Massachusetts. This event was predicted in our First Bulletin. The following is taken from the New York *Times* of April 23rd:

"The company was organized with Col. Fred Grant as President, Edward H. Goff as Vice President, Eugene M. Hersey as Treasurer, and Edward H. Hastings as Secretary. Among the Directors were William Windom, formerly Secretary of the Treasury, and other prominent gentlemen of Washington. A conspicuous office was taken in Tremont-street, and an elegant display was made with incandescent electric lights and prominent advertisements. Overtures were made to Cyrus S. Haldeman, the New-England agent of the Pennsylvania Railroad Company, to become general manager, which he finally accepted, and immediately began operations to place the business on a commercial basis. A plant was prepared, and the parent company in New York was called upon for machines and lamps, and at the same time efforts were made to place the capital stock upon the market in order to raise funds for the prosecution of the business and to meet the large payments due to the New York persons. It was soon discovered that supplies could not be furnished. * * * About two weeks ago Mr. Goff gave notice to the principal stockholders, as well as Grant and Moriarty, that he could not go on with his contract—in the first place, because of the impossibility to raise money and because the parent company have never given any valuable consideration for the money already paid; that they had no system, no machines,

and no lamps of any value, and that he had never used anything belonging to it except the name, and desired to hand over all the papers, contracts, and stock to some person authorized to receive them, with the resignations of himself and associates. No attention having been paid to his several requests, he closed the office of the company, took other quarters, and organized another company under the title of the American Electric and Illuminating Company, based upon contracts with the New-Britain company."

ENGLISH GAS OFFICIALS AND ELECTRIC LIGHTS. Three hundred and sixty members and friends of the English Gas Institute recently visited the Electrical Exposition at the Crystal Palace, and then dined together. After dinner, the President, Mr. G. Wilson Stevenson, C. E., F. G. S. made a speech. Speaking of of arc lamps he said:

"The arc lamp is quite out of the running for domestic lighting; but the incandescent lamp affords a light as nearly perfect, when it is at its best, as any artificial light can be. I can imagine that there are those among us who would be disposed to go so far as to admit that it is nearly as good as 16 candle gas, when burned under the best conditions. There are circumstances under which I could conceive that the incandescent lamp would be preferable to any other light, either of coal gas or oil gas as, for instance, a residence in the tropics, with the thermometer at 90 in the shade all the year around."

Regarding the effect which the electric arc light has thus far had upon the gas business, the following additional extract from the speech is of interest:

"The Electric Light is doing us good there is no doubt whatever about it. It is not an enemy but a friend. People have learned how a huge light may be produced by artificial means. They seek to have more light for themselves; and they say to us, "Can you give us a better light from gas?" Our answer is, "Certainly. If you will pay for it we will give you any amount of light you please." And it is a fact that where electric lighting has been introduced a larger quantity of gas has been consumed. At the same time we are not warranted in despising this competitor."

LIFE OF LAMPS. We are gradually accumulating valuable information about the life of our lamps. Experience shows that when a plant is started, one or two lamps may break at once, while some

last say over two thousand hours of actual burning. What is important is to ascertain the *average* life of the lamps. At the Hotel Everett, New York, fifty-two lamps were burned 152 hours before a single lamp gave out. That is an exceptionally good run. Mr. George H. Bliss writes from Chicago that the present average life of the lamps in Messrs. Rand, McNally & Co's plant is *623* hours; that the average life at the United States Rolling Stock Co's is *639* hours; and that the average life in the plant of Messrs. Marshall Field & Co. is, up to the present time, 608 hours. The above three plants have recently been installed and have not been burning long enough to show the real average. A recent test of 23 different sets of our lamps shows an average life for the entire 23 sets, burning at 16 candles, of 965 hours. An interesting laboratory test is that of 10 lamps, selected at random at the Lamp Factory, at Menlo Park, and started burning, at 16 candles, April 18th, 1881. The date of breakage of each lamp, the number of hours burned, and the average life (which was 1,425 hours), are given below.

Date of Breaking.			Hours Burned.			
April	18,	10.25 A. M.	0	hours.	20	minutes.
May	10,	11 P. M.	174	"	20	"
June	15,	4.05 P. M.	753	"	3	"
"	29,	5 P. M.	648	"	38	"
July	7,	4.30 A. M.	1,047	"	13	"
Aug.	30,	4 P. M.	1,600	"	16	"
Sept.	9,	2.30 P. M.	1,787	"	11	"
"	16,	4.45 P. M.	1,920	"	31	"
Nov.	14,	4.25 P. M.	2,817	"	[illegible]	"
Dec.	7,	3.30 P. M.	3,186	"	41	"

Average life 1,425 hours.

All the above lamps gave an economy of six lamps per indicated horse power. Most inventors in incandescent lighting, in considering the *life of a lamp*, omit the equally important question of *economy per horse power*. But it must always be remembered that the life of a lamp *increases* as the number of lamps per horse power *decreases*, and *vice versa*:

THURBER'S PLANT TO BE INCREASED. The new engine in the wholesale grocery store of Messrs. H. K. & F. B. Thurber & Co., New York City, has been placed in position, and the light is giving such good satisfaction that the firm has ordered an additional dynamo, which will double the present number of lamps, and make them sufficient to light the principal part of the store.

THE EDISON LIGHT AT EATON HALL. We learn from a recent London letter that the Duke of Westminster, who requires 2,000 lights for his country seat at Eaton Hall, has determined to adopt the Edison System. Eaton Hall is well known to travellers as being one of the finest, if not the very finest, country seat in England.

PLANT AT HOLYOKE. The Merrick Thread Works, Holyoke, Mass., has ordered a plant of 120 B lamps.

THE CRYSTAL PALACE AGAIN. The London papers contain lengthy accounts of a recent visit by the Prince and Princess of Wales and suite to the Electrical Exhibition at the Crystal Palace. The following is from a long account of their visit published in the *Chronicle*, March 27th:

"The Entertainment Court, is one of the chief glories of the Electrical Exhibition. There Mr. Edison, the wonderful American electrician, has a display of his incandescent electric lights, which is not to be surpassed. * * * Before the Prince and the Princess of Wales left the Entertainment Court a present was made to them. It was a piece of gilt brass work, with electric lamps, made to resemble a bouquet; and, indeed, with the lamps upon it lighted in coloured glass it would be an artificial bouquet. It was a fine example of the workmanship of Messrs. Verity and Sons, reproducing in brass the outlines of flowers, and with the aid of stored electricity in the bouquet it would be possible to illuminate it, on touching a button, so that it would sparkle with light, while the lamps could be extinguished in an instant. This present bore the following inscription :- "A souvenir of the visit of their Royal Highnesses the Prince and the Princess of Wales to the Electrical Exhibition at

the Crystal Palace, 1882, with the compliments of Thomas Alva Edison, Menlo Park, New Jersey."

The following is taken from the London *Times*, March 27th:

"The Princess seemed particularly interested with the Edison exhibition of incandescent illumination in the Entertainment Court. Here she was pleased to accept from Messrs. Edison and Verity, as a souvenir of her visit, a very charming electric lamp. It takes the shape of an artistically-arranged bouquet of leaves and flowers in delicately-hammered brass-work, with an incandescent electric lamp rising from the centre, and partially hidden among the leaves and flowers."

The *Telegraph* says:

"In the Entertainment Court Mr. Johnson presented to the Princess of Wales, on behalf of Mr. Edison and Messrs. Verity, an incandescent lamp worked into a miniature chandelier, fashioned like a floral bouquet, and suitably inscribed. An experiment was made before their Royal Highnesses in the same court of much interest. Mr. Johnson broke in succession three small lamps, wrapped closely in muslin, with the object of showing that although the inflammable fabric was pressed instantaneously on the white-hot filament it did not take fire. The explanation, of course, is that the inrush of air so rapidly destroys the fine thread of carbon and stops the current that it has no time to ignite the muslin. The importance of this fact in regard to the safety of theatres and other public buildings from an ever-present danger needs no comment. Within the last ten days a well known electrician declared in public that he should have no fear of breaking the lamp in the centre of a powder barrel—a degree of confidence, however, in which the general public might excusably decline to share."

The following is from the *Standard*:

"The Entertainment Court was occupied by the incandescent lights of Mr Edison. Mr. Johnson, his *alter ego* in our country, turned off some of the one hundred and twenty incandescent lights in the gorgeous and gigantic gilt-brass electrolier; then more; and, again in sets, turned them all out, and then flashed them all alight again together; broke incandescent lamps enclosed in a cambric handkerchief, to convince the Royal spectators of the non-incendiary character of incandescent filaments; showed the Princess the reflection of her face in mirrors lighted by invisible lamps; and, finally, offered her a group of little lamps, mounted in a bouquet of brass-gilt fern leaves and flowers; and all this was done with a brevity, promptitude, and precision as admirable in their effect, as they were remarkable in an American."

The London *Daily News*, April 8th, pays a handsome compliment to the Edison System. It says:

"There are two questions to solve besides the production of a lamp, viz.: the proper distribution of electricity throughout a town, and its economy relative to gas. Mr. Edison is far and away in advance of all rivals in the solution of these problems. His exhibition is the wonder of the show, and his representative is certainly the prince of all showmen. There is but one Edison, and Johnson is his prophet. One feels after an hour with Mr. Johnson that there is nothing left to be done, that one's gas shares must be sold at once, that there is only one system, and that is Edison's and that every question has been solved.

The London papers also contain lengthy accounts of the visit of Mr. Gladstone, accompanied by a distinguished party, to the Crystal Palace, March 20th. The *Chronicle* speaks of the visit as follows:

"The visitors afterwards went to the Edison exhibition room, where they were received by Mr. Johnson, the inventor's representative in this country. That gentleman briefly explained the Edison system, which he said was based on the same plan as that pursued in the production and distribution of gas. They had first their head station for generating, next their distributing system, which was by triple wires, so that all three must fail before the light failed, and their meter system. The Premier and the rest of the party apparently followed the line of Mr. Johnson's remarks very closely, Mr. Forster asking several questions respecting the different kinds of electric lights. * * * A small Edison incandescent lamp was purposely broken in one of the rooms to show the visitors the strength of the glass, and that there was no danger to be apprehended even in case of breakage. Mr. and Mrs. Gladstone laughingly protested against anything being broken to commemorate the visit, but the exhibitor remorselessly destroyed the glass."

THE McCORMICK COMPANY, CHICAGO, TO BE LIGHTED. The McCormick Harvesting Machine Co., which was established in 1831, and is the largest of its kind in the country, has given an order to the Isolated Company, for an Edison plant of 130 B lamps.

A LONDON CHURCH LIGHTED. NO HEAT. The City Temple (Dr. Parker's church in London) is lighted by the Edison Light. The current is furnished from the Holborn Viaduct Station. Heretofore the church has been lighted by 700 small gas jets, which have now been replaced by 170 Edison lamps. The heat from the gas was oppressive, and the absence of heat now that the Edison

light is used is very noticeable. Mr. A. Odell, the janitor of the Church, has made careful observations of the difference in temperature. He states that the general temperature when gas was used, was from 83° to 86°, but that the use of the electric light has reduced the temperature about 20°. His record shows the following as the temperature of the church on the several Sundays mentioned: March 19th, 58°; March 16th, 63°; April 2nd, 68°; April 9th, 68°. He states that the difference in the purity of the atmosphere, also in the temperature, and in the purity and steadiness of the light, is something remarkable and has given great satisfaction and attracted wide spread attention. The Edison lamps are all attached to the existing gas fixtures, and the conducting wires are arranged in six main branches which can be operated from a switch board.

HOLBORN VIADUCT CENTRAL STATION, LONDON. This station is now in successful operation. The current, generated by two Edison steam dynamos, is distributed by means of underground conductors for about half a mile, illumination being furnished for one church, many stores, street lights, and a part of the London General Post Office. A full account of this central station will be published in an early number of the Bulletin.

MR. CLARKE'S REPORT ON UNDERGROUND CONDUCTORS. The following is a report made by Mr. Charles L. Clarke, Engineering Department, Edison Electric Light Company, at the request of the Judiciary Committee of the Senate of the State of Rhode Island, with reference to underground conductors for electric lighting:

To the Honorable Committee on Judiciary of the Senate of the State of Rhode Island, in reference to the disposal of wires to be used for Electric Lighting:

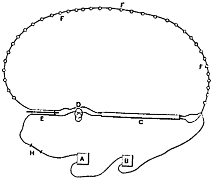
In accordance with my promise, made at the last hearing before your committee, at Providence, March 14th, 1882, I have carried out experiments

upon an arc-light system, operated under a high electrical pressure. The experiments were conducted in a manner to prove, by the practical results obtained, that my statements made at the time of said hearing are true, namely: that, from an electrical point of view, it is perfectly feasible to operate arc-light systems, under great electrical pressure, by means of underground conductors: and that what would be called ordinary insulation is sufficient to prevent disruption of the same and the creation of faults are due to the high pressure. The experiments were conducted at the mills of the Whittendon Manufacturing Company, Taunton, Mass., and every facility for properly conducting the same was placed at my command by the proprietors.

Two Brush dynamos each operating a circuit with eighteen arc lamps, were connected in series and the circuits were connected in the same manner. Thirty-six arc lights were therefore on one circuit operated under a total electrical pressure of at least sixteen hundred volts. The maximum electrical pressure developed under the same conditions would be from a Brush forty-light machine, and would amount to two thousand volts. The electrical pressure developed in this experiment is therefore great enough to bring out defects in the insulating power of the conductors used, and to overcome and disrupt the same if any tendency to do so is an inherent property of the insulating material, for any pressure within the limits that it is possible to construct a practical dynamo machine to exert.

Both the outgoing, and incoming portions of the circuit were carried outside the building, and in this portion of the circuit were interpolated the conductors experimented upon.

The following diagram with accompanying description, will fully explain the manner in which the experiments were conducted.



A and *B* are the dynamos (Brush). *C* is one length (20 feet) of underground conductor as manufactured by the Electric Tube Co. It consists of two copper rods, each equivalent in size to two No. 10 wires, B. W. G. These rods are placed in an iron pipe one inch in diameter, and are electrically insulated from each other and from the iron pipe by means of a compound filling the same. The actual separation of the copper rods is one-quarter of an inch. These rods form a portion of the outgoing and incoming circuit respectively.

D is a portion of these two circuits made of two forty feet lengths of No. 14 iron wire, B. W. G. insulated by a covering of kerite 3-64th of an inch thick. These strands are twisted together and made into a close coil. (I will state that the wire had been in stock for some time and was badly marred. These faults were repaired by dipping the parts in question in the Electric Tube compound and serving with cotton cloth).

E consists of two copper plates between which one thickness of ordinary letter paper is firmly clamped, forming the only insulator between the two.

H is a lead wire introduced into the circuit to prevent injury to the dynamos in case of accidental short circuits or development of faults, occurrence of which would cause the heavy current induced to fuse this lead wire and interrupt the circuit.

F, F, F, is the lamp circuit.

The tube C and coil of wire D were buried underground, and the ground at D was thoroughly saturated with water. All connections made underground were protected by covering them with the Electric Tube Compound.

On Friday, March 24th, the system was operated for two hours and a half without developing any fault.

This is ample time to practically prove the total inability of the electrical pressure under which arc-light systems are operated, to break down and disrupt even what would be called ordinary insulation.

It could not disrupt paper four one-thousandths of an inch thick, did not injure the kerite-covered wire which opposed a total thickness of 3-32 of an inch, and produced no effect on the Electric tube, with conductors separated by one-quarter of an inch of compound.

All that remains to be done to make this underground system reliable and durable is to prevent hardening and cracking of the insulating material by protecting it from the air or fresh water and gases, by a suitable covering (tarred hemp has been employed with the best results), to provide suitable protection againt probable mechanical injury, and to provide means for making tests of the electrical condition of the line and amount of leakage, and to detect the deterioration of any portion of the system and locate the fault.

In the underground line experimented upon, the *Electric Tube* provides insulation and protection from water, air, gases and mechanical injury, and the system, in connection with which this tube is employed, is arranged so as to provide means for testing and locating faults.

At the last hearing I stated that an underground arc light system is in operation in London, and a submarine system at Havre.

The following is descriptive of so much of these systems as will be of interest to your committee, bearing as it does upon the point at issue. The first system mentioned is at the Royal Albert Dock, London; and, at the time of installation, there were three seven-lamp and one six-lamp circuits operated by Siemen's dynamos. The underground conductors supplying this system, (the area illuminated is six thousand five hundred feet long and four hundred and ninety feet wide) are constructed as follows: A copper strand covered first with gutta-percha, then with tarred hemp, then with a sheathing of twenty-two iron wires, and this again is served with another layer of tarred jute, and finally there is a coating of Chatterton's compound, (a mixture of Stockholm tar, resin and gutta-percha) so that the underground wires are in every way, as carefully protected as is the conducting core of a submarine cable. There is no specially provided return circuit, for the iron wire sheathing of the cable circuits plays that part. This provision for a return circuit is to be deprecated. The distances between the lamps and machines, as measured by the connecting conductors, varies from one hundred and twenty to eleven hundred yards. For original description see "*Engineering*," Vol. XXX., page 276.

The second system mentioned is at the docks, port of Havre, France. The number of lamps on a circuit varies from four to six, with a total number of thirty-three on six circuits. The length of these circuits varies from three thousand eight hundred and twenty-eight, to twelve thousand seven hundred and ninety-two feet. The cable is constructed in the following manner: A central core of seven strands of copper wire is enclosed in a sheath of rubber, over which is placed a series of protective coatings of gutta-percha, rubber cloth, and three thicknesses of paraffined hemp wound alternately in opposite directions; then follows a covering of galvanized iron wire, and finally a thickness of hemp. The necessity of this great precaution in protecting the conductors will be understood when it is remembered that the cable has to pass through five locks, so that for the greater part of its length it is under water. One accident to a circuit occurred by the rupture of a water main behind which the cable was placed. This was easily repaired by splicing.

The description further states:

"During the last six months the installation has been in full work, and has been of great service." See "Engineering," Vol. XXXIII., page 6.

Frequent statements have been made in the newspapers to the effect that, granting the fact that underground conductors can be made so as to withstand the high electrical pressure required to operate a circuit of forty or fifty arc lights, and to remain in good condition for a reasonable number of years, the amount of leakage of electricity will be so great as to prevent the commercial success of such a system; and that for this reason only six lights, or ten at the most, could successfully be operated on one underground circuit.

These statements are now so often made, and are becoming so generally believed by the public, who are encouraged in this belief by the advocates of overhead conductors for arc-light systems, that it seems necessary to state the truth about electricity in this respect, especially since everything that is mysterious, capricious and untrue is readily attached to this much-abused agent, and as readily believed by the public.

The conditions of the problem have been assumed in such a manner as to make the leakage even greater than what it would be in practice, and are as follows: Forty arc lights operated under a total electrical pressure of two thousand volts, are placed at intervals of three hundred feet apart, making the total distance twelve thousand feet, and the entire length of circuit twenty-four thousand feet, or more than four and one half miles.

The conductor consists of a No. 6 copper wire covered with an insulation of best gutta-percha one sixteenth of an inch thick. The outgoing and incoming parts of the circuit are placed close together and supposed to be surrounded by some good conductor (acidulated water for example).

The resistance of the insulation of the double cable will be fifty millions of ohms per mile. This resistance opposes the leakage. The total leakage, expressed in work, will amount to two and seventy-seven hundredths ft. lbs. per minute. A good idea of the insignificant loss is given by knowing that it is only the one eleven-thousand-nine-hundredths part of one horse power.

The amount of energy in the lamps will be thirty horse power, of which the leakage is twenty-eight one-hundred thousandths part of one per cent. In order that the leakage may amount to as much as one per cent. the insulation would have to deteriorate to the one thirty-five hundredth part of what it is when at its best. Hooper's india rubber is twenty-hundred per cent. better than gutta-percha as an insulator.

As long as the insulation of an underground conductor is fair and without actual breaks or faults, the leakage in that portion of the circuit is not of the slightest consideration, and it is incorrect and misleading to assume that, from a commercial point of view, it can affect the questions arising in regard to underground conductors. When a leak becomes of sufficient magnitude to affect the economy, it is through a break or fault in the insulation, which would, of necessity, have to be repaired.

I wish to quote at some length from an article which appeared in the "Telegraphic Journal and Electrical Review, Vol. IX.," and which bears directly upon the question of insulation and durability.

"There is undoubtedly a very general impression abroad that high insulation is, above everything, the indication of a sound and good working line, but there cannot be a greater mistake than to suppose this. In certain cases, in gutta-percha for example, excessively high insulation is an indication of a poor quality of material, a quality in fact which is not durable. * * * This is not all, however, for even supposing that high insulation can be obtained consistent with durability, there is nothing whatever gained by a high result

as regards its working value, in fact it is a positive advantage to have low insulation, provided the latter is due to the *nature* of the insulating material, and not to a defect in it." (The author refers particularly to telegraph lines, but the same words apply with equal force to electric light conductors). "But it is very necessary for thorough good working that the low insulation should not be due to a *defect;* the latter *may* improve the working" (of telegraph lines), "but it is much more likely to spoil it by continual variations, hence the problem to be solved in underground lines is *low* insulation (within certain limits of course, for there must be sufficient insulation to enable a good proportion of the transmitted current to be received at the receiving end of the line) consistent with durability."

Thus it will be seen that a very high insulation is not needed in electric-light-underground conductors operated under high pressure, for the loss with extremely low insulation will amount to but a small fraction of one per cent. of the total current; but durability is the object to be obtained.

New York, March 30th, 1882.

Respectfully submitted,
CHAS. L. CLARKE,
Engineering Department,
Edison Electric Light Co.,
New York City.

No. 9.
MAY 15, 1882.

NINTH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the Vice President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

NEW YORK, May 15th, 1882.

PROGRESS IN THE FIRST DISTRICT, NEW YORK CITY.

In the Seventh Bulletin a detailed account was given of the progress made up to that time, and the last Bulletin contained additional information. Prior to April 1st, a little over 55,000 feet of street underground conductors had been laid, including mains on the block fronts, street intersections and feeders. Work on laying intersection safety-catch boxes was commenced experimentally in March, but only one box was actually laid in that month. The next month 13 were put in. In April there were 24 working days, that is to say, days in which the weather admitted of our going on with our work. Of this time 13 days were devoted to the laying of conductors, 10 to safety-catch boxes and their connecting mains, and one to service connections with houses. The total amount of mains laid during April was 12,500 feet, making about 67,700 feet of conductors already put in the ground. On May 1st there yet

remained to be laid, approximately, 14,300 feet, including not only street mains, but also connections at street intersections, feeders, and some extra mains specially required; also 47 street intersection safety-catch boxes; and 48 bridge safety-catch boxes. The present total estimate of underground work already done and yet to be done is about 82,000 feet, including all mains, feeders, bridges and intersections, but not including any house connections under the sidewalks. Regarding the safety-catch boxes, it may be explained here, that at each street intersection a large cast iron box is placed, called a "safety-catch box". All conductors coming together at every street intersection meet in this box, and are so connected that any one can be separated from the system for the purpose of testing its condition touching insulation, or for any other purpose; also each conductor is automatically disconnected in case of a serious "cross" connection or "short circuit" within itself, an occurrence which will happen only in case of severe mechanical injury. The box is accessible through a large hand-hole covered by a heavy iron lid. Three of the six dynamos, mentioned in the last Bulletin as having been already assembled at Goerck Street, have been moved to the central station on Pearl Street and are now being erected there. The other three will follow as soon as the first three are set up and out of the way. The small engine is also now in place to work the blowing apparatus and the conveyors for coal and ashes. From this account it will be seen that rapid progress is being made towards completion, and that before many weeks the light will be turned on in the First District.

MR. BENNETT'S YACHT, NAMOUNA. Mr. James Gordon Bennett's yacht, "Namouna," has just been lighted. There are 120 of our B Lamps (8 candle power), and the dynamo is driven by a 6½ x 8 engine, the steam for the engine being supplied from either the main boilers or a donkey boiler, and the exhaust steam being deliv-

ered either into the condenser or through the side of the vessel, as may be desired. In addition to the general arrangement of lamps through the cabins and saloons, lamps have been placed in the shaft alley, where there are no means for ventilation other than through the engine room, and lamps with long flexible connections have been furnished for the boiler and engine room, so that they can be carried to examine any part of the machinery or boilers.

TRENTON, NEW JERSEY. We have received an order from Mr. William Hewitt for an isolated plant in the wire mill of the Trenton Iron Company, to replace arc lights. The plant is now being installed.

THE GRAMME COMPANY. WHY WE JOINED IT. The newspaper comments about our joining the Gramme Company are misleading. The inference from them is that there has been a sort of "amalgamation" of interests, whereby the Edison Company has surrendered its autonomy and merged itself in another organization. Nothing could be more erroneous. The Gramme Company is simply a union of certain electrical companies for mutual convenience in transacting business and for protecting both the public and themselves against incompetent and in many cases swindling outside companies. The companies belonging to the Gramme association maintain their individuality intact, just as if no such union existed. There is no pooling of earnings, no parcelling out of territory, no surrender of patents, no system of mutual licensing, and no abridgment whatever of the right and power to sue each other and to sue outsiders.

The Gramme patent (U. S. patent No. 120,057, granted October 17th, 1871), is for an improved dynamo, or, as the patent reads, for "an improvement in magneto-electric machines." In May 1879, that patent was offered for sale to our Company. After taking the

advice of Mr. Edison and our counsel in patent matters, we decided not to buy it. Among other reasons for our refusal was the fact that although most other inventors used the Gramme patent and made a machine more or less like the Gramme, Mr. Edison's machine was made upon an entirely different principle, and did not infringe the Gramme patent. After our Company refused to buy, the patent was sold to another company. Early last year that company thought that inasmuch as most of the dynamo-machines, aside from Edison's, infringed the Gramme patent, a union of the leading light companies might be formed to purchase that patent, to then license each other, and to thus obtain a practical monopoly of the electric light business. In March 1881, our company was invited to take the lead in getting up such an organization. After careful consideration we decided not to do so. We reached that decision for the same reasons given above for our not originally buying the Gramme patent. Subsequently, however, the proposed union was effected without our Company, and on April 27th, the present Gramme Electrical Company was formed, our Company still declining to join it, but a vacancy being kept for us.

Matters continued in this shape several months, until, in August, conference committees were appointed on the part of the Gramme Company and our own, to see if it was not for our interest yet to join the union. The arguments presented to us were, first, that the Gramme Company was rendering both the public and ourselves good service in exterminating dishonest and incompetent light companies, also blackmailing companies springing up almost daily to steal our patents and otherwise annoy us, in the hopes of being bought off; second, that a large amount of detail work of mutual interest to all parties engaged in electric lighting could be done by one central organization, thereby saving the expense and trouble of each company's doing it for itself; and, third, that the general business of electric light-

ing could be harmonized and made to work with less friction and expense, if the leading companies would unite in a policy of uniformity of prices, of referring disputed issues to arbitration, and of quickening and cheapening patent litigation between themselves. One of these arguments, namely, uniformity of prices, had little influence with us. We were and are engaged exclusively in incandescent lighting, of which we have a monopoly, whereas all the other companies are engaged in arc lighting, wherein the competition is fierce, and they all suffer from the cutting of prices. Still, aside from this question of prices, the other arguments had great weight with our committee, and in February, this year, they reported to our Company in favor of our joining the combination. We found no difficulty in arranging satisfactory terms and conditions, and in March we accordingly became members of the Gramme Electrical Company.

From the above statement of facts, it will be seen that we have in no sense whatever surrendered our individuality, parted with any of our rights, or, even in the slightest degree, altered our established position as sole inventors and exclusive proprietors of a system of incandescent lighting.

BERLIN, GERMANY. The Berlin Stock Exchange Newspaper, called the *Berliner Boersen Courier*, is lighted with one of our isolated plants. The issue of that paper, April 13th, speaks of the light as follows:

"In the printing establishment of the *Berliner Boersen Courier*, Edison's new electric incandescent lamp has, for the first time in Berlin, demonstrated its capabilities. Sixty lamps for which the same steam-engine whose power printed these lines, produced the electricity, have furnished the light for the printing of the present number of this paper. Aside from the editorial rooms where the electric light has been introduced, we will only speak of the effect of the electric light in the compositors' rooms. For each of the cases of the compositors is one lamp. The light is not dazzling or intense as in the case of the electric light hitherto known, nor does it cast those well-known intensely dark shadows, neither has it that spectral tint which has rendered

the electric light hitherto known in Berlin somewhat ghastly and unpleasant. It is a cosy light and a powerful one withal. Hitherto the gas jets created nightly an unbearable heat and vitiated the atmosphere in our spacious composing-rooms; but nothing of this is noticeable in this Edison illumination. The compositors had hitherto to stand the hot flame of the gas in close proximity to their heads, while in the Edison incandescent lamp even the glass-globe remains almost cool. Whatever the relative cost of illumination by gas and by electricity will be, we are of course unable to say as yet from practical experience, but to all appearances the superior electric light will prove rather cheaper than dearer, than the inferior gas light. Our composing room is the first electrically illuminated work-room in Berlin, and the first exhibition of this light has proved a brilliant success."

HOW OUR UNDERGROUND CONDUCTORS STAND THE WEATHER. In order to make connections at the street crossings in the Pearl Street District, we have recently been obliged to expose the ends of the underground conductors which were laid early last Autumn. We find upon testing them, that they have stood the winter weather without the slighest deterioration, and that they test perfectly, just as when they were first laid.

PLANT AT PASSAIC. A plant of 120 eight candle B and 12 sixteen candle B lamps has just been successfully started in the Woolen Mill of the Rittenhouse Manufacturing Co., Passaic, N. J. The dynamo is run by water power, and the plant is used all night.

PURITY OF GAS AND ELECTRIC LIGHT COMPARED. We quote the following from a recent interview with Mr. Edison, published in a western paper, on the subject of electric lighting and of its merits as compared with the existing gas system:

"Gas is a barbarous and wasteful light. The distribution of gas through a city is done by means of an immense system of sewerage pipe, through which it is forced and kept under pressure—a gas reeking with impure material and made by a dozen different processes. This gas is allowed to escape through holes into our apartments where it is burnt, taking oxygen from the air to support combustion, the products of which are carbonic acid, carbonic oxide, sulphuric acid, sulphuretted hydrogen, and a host of other substances, which

vitiate the atmosphere. It thus gives 98½ per cent. more heat than light. In fact the result of the vile poison is almost entirely heat and only incidentally a little light. It is a yellow light, too, and far removed from the color of natural light. And it is charged for by quantity and not by quality, for it is passed through meters which measure the quantity and not the quality of the light—certainly a wrong system. At the source of supply the crude material from which this gas is made, namely, the coal, is passed through a distillation process, from which it is liberated from the other constituents of the coal, more or less imperfectly. It is then stowed in the gasometer ready for distribution. This is one half of the process. The other and final portion of the process takes place in our sitting and bed-rooms, much to the detriment of our health, our sight and our household effects. In other words, matter is sent into dwellings for the ostensible purpose of producing light, whereas its main product is heat."

"Well, how as to the manufacture of the electric light, Mr. Edison?"

"In the case of the electric light nothing is sent into the house but energy whereby the light is produced, and a very small amount of heat, about 6½ per cent. as compared with the amount of light. It does not flicker, it does not vitiate the atmosphere. It shows colors in their natural hues, and does not hurt the eye. The meter measures quality and quantity both."

HOLBORN VIADUCT CENTRAL STATION, LONDON. The district lighted by the Holborn Viaduct Central Station, London, is one-half mile in length, extending from Holborn Circus along Holborn Viaduct and Newgate Street to the General Post Office. From Holborn Circus to the Viaduct Tavern at Giltspur Street, the conductors are placed underground in the "subway," a sort of subterranean tunnel to contain gas and water mains; and from the Viaduct Tavern to the General Post Office the conductors are carried over the tops of the houses, a distance of about one-fifth of a mile. The Central Station, where the dynamos are located for generating the current, is located at No. 57 Holborn Viaduct, nearly opposite Spiers and Pond's Hotel. The lamps are arranged on four separate circuits, instead of on a single circuit, an arrangement adopted as the most convenient for illustrating, by extinguishing only the lamps in a single circuit at a time, how readily, by a slight movement of the hand, the lamps on an entire circuit may be instantly lighted or extinguished. General-

ly speaking, the subdivision of circuits is as follows: one circuit on each side of the street from the Central Station to Holborn Circus, and one circuit on each side of the street from the Central Station to Old Bailey on one side, and from the Central Station to the General Post Office on the other side. In the first circuit there are 66 street lights, also 78 lights distributed in nine buildings, the occupants of the buildings being the firms of Negretti & Zambra, Sharp & Co., Vaseline Co., Hodge & Essex, Holland, McConnell & Co., Steal & Garland, W. D. & H. O. Wills, Terry & Co., and J. Buck. In the second circuit there are 40 street lights and 49 lights distributed in seven buildings, and among the following parties, to wit: H. S. Ward & Co., Smith & Son, Dreydell & Co., Boyle & Co., Jenks & Wood, and the City Rubber Stamp Co. In the third circuit there are 27 street lights and 162 lights distributed among the following consumers, namely, Spiers & Pond's Hotel and Restaurant (68 lights), Monington & Weston, London, Chatham & Dover R. R., Coventry Machinists Co., Perry & Co. (24 lights), Pall Mall Electric Association, Meriden Britannia Co., Holborn Lancet Co., Levy & Nephews, and the Imperial Hotel (27 lights). In the fourth circuit there are 31 street lamps and 172 lights in Lasher & Son's and the City Temple. There are also 232 lamps in the company's Central Station, 31 in the Viaduct Tavern, and 50 in the General Post Office. The total number of lamps thus used is 938. Besides these there are also additional lamps distributed miscellaneously, bringing up the total number of lamps to about one thousand. The street lamps are 32-candle power, there are seventy-four 8-candle lamps, and the balance are all 16-candle.

WHAT THE LONDON PRESS SAYS ABOUT IT. The London papers contain lengthy reports of the successful starting of the Holborn Viaduct Station, and judging from them and from our office correspondence, the event must have created a marked sensation in

scientific and financial circles. We have room for only a few extracts from the London papers.

The London *Times*, April 13, said:

"A demonstration of Mr. Edison's system of lighting the buildings and streets of a district may now be seen in London. From Newgate street westward across the Holborn Viaduct, to Hatton garden, the street and most of the buildings on either side of the street are now, and for the next two months, will continue to be lit by Edison incandescent lamps. For the purpose of street lighting two of the incandescent lamps of 32 candle power each have been placed in every lamp post in this section. * * * Those who can obtain permission to see the machinery and appliances by which the electricity is generated and distributed will find a satisfactory answer to the question which has often been asked during the last four or five years. What is Mr. Edison doing? * * * For the first time in the history of electric lighting, he would claim, there is here perfected a system of electrical supply, consisting of means for manufacturing, regulating, distributing, and measuring electricity by meters for purposes of general consumption by all the inhabitants of a town, and not by a few individuals, whether for lighting, for driving machinery, supplying electric bells, working telephones, or for any other purpose to which electricity is now or may hereafter be put. First, as to the manufacture. There is in the basement of the premises of the Edison Electric Light Company, (Limited), No. 57 Holborn Viaduct, the large dynamo-machine, by which all the lights in the district, nearly 1,000 in number, are supplied. It is called a thousand light machine, but is capable of supplying more. That is to say, as with the machines at the Crystal Palace, Mr. Edison prefers that, as a matter of economy, the machines shall be worked considerably below their power. One noticeable point in the system is its safety. The electric pressure, to borrow a term from the system of gas distributors, is so low that a child may hold the electrodes without danger; and with regard to the safety of the lamp, a handkerchief being placed over one of the globes and the glass being shattered, the instantaneous extinguishing of the light by the destruction of the vacuum is all that happens. The handkerchief is not even singed. The dynamo-machine is worked by a Porter-Allen high pressure engine of 150 horse power indicated, causing the armature to make 350 revolutions per minute. Generator and steam engine are firmly fastened together on the same cast-iron bed plate, the engine driving the armature, which is mounted on the crank shaft, directly and without the use of belting. Steadiness of speed is further insured by a sensitive governor, and as lights in a circuit are turned out, say when a theatre performance or a church service is over, the safety of the lamps remaining alight is provided for by a resistance regulator under the care of a man in the photometer and dynamometer room, the engineer proportionately diminishing the work of the engine. The armature is kept cool by a small blow-

ing fan, driven by the engine. * * * Small plugs, each containing a piece of lead wire, which will fuse and break contact should the current become too strong, serve automatically to protect the carbon filaments in the lamps from any sudden and accidental rush of electricity to one point in the system. The conducting mains are copper rods insulated in prepared wood and enclosed in iron tubes to prevent leakage. Another remarkably ingenious piece of apparatus is the meter for measuring the quantity of electricity consumed by each customer. This is a bottle containing two plates of zinc in a solution of zinc sulphate, the current in passing causing the one plate to increase in weight at the expense of the other. As, however, if the whole current passed through the bottle this change would go on too rapidly, a properly proportioned shunt wire allows just 1 870th of the electricity going into the house main to pass through the meter. The estimate of the quantity consumed is made once a quarter, or as often as may be convenient, by weighing the plates in the bottle, a second bottle being supplied, the plates of which the consumer may weigh for himself as a check upon the company."

The London *Standard*, April 13th, contains a lengthy notice from which the following is taken:

The Edison "system" is the tangible reply to the question he set himself to solve in the way he individually thought best—"Is it possible to employ electricity as an illuminating agent, not merely as an accessory to gas or as useful in exceptional cases, but as a practical and reliable means of illumination, safe in use, readily adapted, certain in action, and accurately measurable?" This is a wider problem than the production of a useful electric light, or the subdivision of an electric current into a few lights; the difference, in fact, being the difference between producing an electric light and a system of electric lighting. * * * It is understood that the present installation will be made to give exact details of cost of plant, maintenance of lighting service, and all other details, necessary to enable an absolute comparison of the actual cost of the Edison system to be made in regard to the comparative lighting of the same district by gas. In two months a report to this end is to be made by Dr. Hopkinson and Dr. Fleming, and published to the world."

A BOSTON PAPER ON THE LONDON PLANT. The Boston Daily *Advertiser*, April 20th, prints the following notice of the Holborn Viaduct Station, London:

"A demonstration of Mr. Edison's system of lighting the buildings and streets of a district may be seen now in London. The district lighted is supplied by four circuits, and there are nearly one thousand lights in all. For example, in the third circuit there are twenty-four street lights, and nine lights in front of the London and Dover railway station, together with lights in warehouses

and restaurants. In the office on the Holborn Viaduct is the dynamo-machine which supplies the district. The claim for this London exhibition is, that for the first time there is shown a perfect system of electrical supply, means for manufacturing, regulating, distributing and measuring electricity by meters for general consumption. The equable distribution of electricity over the district is a prominent feature in Mr. Edison's plan, so that at any point of the wires a lamp attached will have the same illuminating power as a lamp at any other point. Steadiness of speed is secured, and when lights in a circuit are turned out, the safety of the lights remaining lighted is insured by a resistance regulator in charge of a man in the dynamometer room, the engine's speed being slackened in due proportion. The electric pressure throughout the circuit is so low that a child can hold the electrodes without risk. Another illustration of the safety of the system is given by the experiment of placing a handkerchief over a globe and shattering the glass, the only result being the extinguishing of the light by the destruction of the vacuum. The insurance companies take the risk of the central office at an exceptionally low rate, though hundreds of lamps are there to increase the danger of injury to property. The question of cost depends at present largely upon calculation. Mr. Edison's London agent claims that the electric light can be given away, if need be, so large will be the revenue from renting electricity for other purposes, such as the movement of machinery, telephones and electric bells. The success of the experiment in extensive lighting is undoubted, while the comparative safety and expense of electric lighting are matters to be determined by full and continuous experience."

MISSTATEMENTS ABOUT TWO PLANTS CORRECTED. At a meeting of the Society of Arts, held at the Institute of Technology, Boston, Thursday evening, April 27th, the subject of electric lighting was discussed. During the discussion an officer of a gas company in Boston, in the course of his remarks upon gas and electric lights, made certain statements regarding the economy and efficiency of the Edison light. He illustrated his remarks by stating that at the Pemberton Mills, Lawrence, Mass., "the Edison system was not working well, that for 140 "B" lights there the power required had been demonstrated to be largely in excess of the amount as stated by the Edison Company, and that the Pemberton Company had been obliged to stop the dynamo frequently on account of heated bearings". In order to test the accuracy of

this statement, the Manager of the Isolated Company at once wrote to Mr. Clarke, Agent of the Pemberton Company, and received the following reply:

"PEMBERTON COMPANY, Agent's Office,
LAWRENCE, MASS., May 1st, 1882.

M. F. MOORE, Esq., General Manager Edison Company for Isolated Lighting.

DEAR SIR, - I am in receipt of yours of April 30th, referring to a statement made at a meeting of the Society of Arts held in Boston on the evening of April 27th, by a 'Representative of a gas Company' concerning the Edison apparatus in operation at this mill. I have investigated thoroughly the matter, and the person in charge of said apparatus states that he has never made any such statement as you say was imputed to him. The facts in regard to the operation of your electric lights here, are:

FIRST. We have never run 140 'B' lights. We are running one of your dynamos with 64 'A' lights, with considerable less power than you have ever claimed for it.

SECOND. The dynamo has never stopped one moment from heated bearings, and scarcely a moment from any cause whatever, since it was introduced here six months ago, except during the stoppage of the works. It has run steadily ten hours each day since starting, and is as successful and satisfactory to day as upon the day of its introduction.

Yours truly,
F. E. CLARKE, Agent."

At the same meeting in Boston, statements similar to those made about the Pemberton plant, were also made derogatory to the Edison plant burning in the establishment of John P. Squire & Co., East Cambridge. We at once acquainted that firm with what was said, and have received from them a letter stating that the reflections were entirely groundless. They say that the plant is in good condition and that they consider the light all that it was ever recommended to be; and as regards the power required to run the dynamo (which we stated to them and have everywhere stated would be about 8 H. P.,) they say: "We have run the dynamo about 4 hours a day at not over 7 or under 6 horsepower."

Ordinarily we do not take the trouble to deny misstatements about our plants, but we do so in this case, for the reason that the statements were made with a good deal of particularity, and in a public

place, and in the presence of an important body of men, who are entitled to know the truth.

DYNAMOS IN MULTIPLE ARC. Mr. Johnson has been running 12 Z dynamos in multiple arc at the Crystal Palace, also two Edison steam dynamos in multiple arc on the Holborn Viaduct, and he states they all work to perfection. This successful attempt to run two mammoth dynamos in the same circuit is an event of such scientific importance as to be entitled to especial mention. It was done for the first time on the night of April 8th, 1882, and took place under the direction of Mr. Johnson at the Edison Central Station, Holborn Viaduct, London.

REPORT OF W. H. PREECE ON ELECTRIC LIGHTS. The following report, obtained in London by Thomas Swinyard, Esq., Vice President of the Dominion Telegraph Company of Canada, has been presented to the Canadian Parliament. The paper has a general interest as showing the exact present state of the new art of Electric Lighting, and a particular interest as showing the writer's preference for the Edison system. Mr. Preece is the Electrician of the British Postal Telegraph, and was in constant attendance at the recent Electricial Exposition at Paris, as Commissioner of the English Government. An extract from this report was printed in the Sixth Bulletin, but we now reprint the paper entire as it comes to us from Canada.

"Report by W. H. PREECE, Esq., F. R. S., London, Eng., to Thomas Swinyard, Esq., Vice President Dominion Telegraph Company of Canada, on the progress of the Electric Light in England, submitted to, and printed by request of The Private Bills Committee, House of Commons, Ottawa, 10th March, 1882.

"The Electric Light during the past two years has made wonderful and rapid strides, and England has now really put herself in the van of progress in this respect.

THE ARC LIGHT SYSTEMS. The Illumination of Streets by means of the Electric light was begun in Paris, but the length of streets so lighted up, has not increased since 1878. In England, however, about six miles of streets in the city of London are regularly illuminated in this way. In one case, the works at which the electricity is generated, are situated at Lambeth, over one mile from the city, and forty lamps are maintained in action over a circuit of more than two miles in length. This is the Brush system. The large spaces in front of the Guildhall; the Mansion House; the Royal Exchange; and Lombard street, are illuminated by magnificent lamps on the Siemens system, and the road from London bridge to the Mansion House, is also illuminated by smaller lamps of that celebrated firm. Queen Victoria street from the Mansion House to Blackfriars Bridge, is lighted up by the Electric Light and Power Generating Company; but this has been the least successful of the experiments made. The most striking Arc system is that of Siemens. The Brush light is expensive in its first cost, and it possesses a wavering and an unsteadiness which is extremely irritating to the eyes of passers by. At Edinburgh it was considered such a failure that an order was given for its removal, and it had to be carried out. (It failed from the gross ignorance with which the wires were erected.) The British Electric Light Company attempted to light up a portion of Liverpool, but from some cause or other, of which I am ignorant, it was a failure. There is, however, no doubt whatever that the practicability and feasibility of the Electric Light for the illumination of streets and of large areas, have been incontestibly proved by the experiments in London.

RAILWAY STATIONS. A great many Railway Stations have also been illuminated:—in fact all the chief railway stations in London, have in use one system or other. Paddington Station, of the Great Western Railway; Liverpool Street Station, of the Great Eastern Railway; Waterloo Station, of the South Western Railway; and Charing Cross, of the South Eastern Railway, are illuminated by the Brush Electric Light Company; and the Station at Cannon Street, also on the South Eastern, by the Brockie system. King's Cross Station of the Midland Railway, is illuminated by the Crompton system. Of these different systems, the most successful are the Crompton and Brockie; for the Cannon street and King's Cross Stations are almost perfectly illuminated for railway requirements. At Glasgow two stations, viz: St. Enoch's Square and Queen Street, are lighted up by the Crompton system.

DOCKS. Several Docks have been illuminated, notably the new Albert Docks on the Thames, where the Quays of nearly two miles in length are illuminated as if by daylight, while the portable apparatus is used to convey the Light into the Sheds, and even on board the Ships.

MARINE PARADES. Two or three Marine Parades have been illuminated most successfully. At Blackpool, in Lancashire, several of Siemen's magnificent lamps light up the Grand Parade in that town and the sea in the immediate

neighborhood. At Brighton, experiments have been made in this direction, and the authorities contemplate lighting up the Parade.

LIGHT-HOUSES. For Light-house purposes the Electric Light has been a fixed practice now for more than twenty years, and owing to the recent advance in the character of machines and in the steadiness and quality of the lamps, the Trinity House Brethren are extending the system, and two or three new light-houses are being fitted up with the Electric Light.

POST OFFICES. At several of the Post Offices in this country we have experimented with the Electric Light for Telegraph and Sorting purposes. The Telegraph and Instrument Room and Sorting Office at Glasgow have been experimentally illuminated for twelve months with such success that it is going to be made permanent. The system used is the Crompton Arc Lamp. The Sorting Office at Edinburgh is also illuminated, but there the Maxim Incandescent Lamp is used. It affords a certain amount of satisfaction, but is an expensive mode of illumination. At the General Post Office, London, we have tried the Brush, the Brockie, and the Lane Fox, and we are now about to try the Edison system.

It will be seen from the above remarks that most of the experiments that have been tried and the installations that have hitherto been made, have been in connection with Arc Lamps, but the results of the experiments and the lessons learned in Paris, show unmistakably that the Arc Lamp is only suitable for Streets and large spaces; and that for internal purposes, for office work and household purposes, there can be no question whatever that the system by incandescence is that which will eventually supplant Gas.

THE INCANDESCENT LIGHT SYSTEMS. There are two or three houses in which this light is in use in England—at Mr. Spottiswoode's town house in Grosvenor Place, and at his country residence at Seven Oaks; at Sir Wm. Armstrong's, near Newcastle, and at Sir Wm. Thomson's, at Glasgow. I hope shortly to light up my own house by the Incandescent Light.

There are four systems of Incandescent Light now on trial: The Swan; The Lane Fox; the Maxim; and the Edison. I have examined them all with very great care, and I have come to the conclusion that by far the best in all its details is that of Mr. Edison—in fact, his system leaves little to be desired.

A magnificent display of the Edison system has been made at the Crystal Palace. The Concert Room has been illuminated every night for the past fortnight, and has met with nothing but the highest approval. A Central Station has been established on the Holborn Viaduct, and very soon the whole of the Viaduct and every shop and house upon it will be illuminated. The Post Office authorities are going to light up one of their galleries from this centre, and the experiment of distributing the Electric Light on a grand scale is about to be thoroughly started. I have no doubt of its success, and my opinion of the perfection and completion of the Edison system is fully given in the paper read before the Society of Arts, which I annex.

GENERAL REMARKS. The price of Gas in England is in many places so cheap that it is scarcely possible to hope that from an economical point of view, the Electric Light will supplant Gas, but there is no doubt of this, that not only are there many places where Gas is so dear that the Electric Light would be cheaper, but Gas can be used as a motive power to better advantage. One thousand cubic feet of Gas will give considerably more light if employed as a motor for the production of the Electric Light, than if burnt in the ordinary way from a burner, and it is in this direction that the practical illumination of houses will be carried out; for Gas engines are so easily managed that gardeners and men servants can attend to them, and they can thus be utilized to rotate dynamos.

In the recent foggy weather in London, the utility of the Electric Light has been most marked, for although it has no more penetrating power than Gas light and cannot be seen further in a fog, nevertheless the very cause which prevents the light being thrown to a distance, is why the space around the lamp is better illuminated, for the rays of light are reflected back by the small particles making up the fog.

The principal advantages of the Electric Light, is not only that it gives a purer and steadier light, but that it removes from the atmosphere all those gases which vitiate it; and although the Electric Light is itself a great source of heat, the air around it is not thrown into circulation as is the case with Gas. A most striking case in point, is that of the Savoy Theatre. Here 1200 lamps illuminate the Auditorium and the Stage; and the chief disadvantage is said to be that it makes the house too cold. I think, however, that this expression of opinion is merely relative, for we found a similar complaint was made at one of our post offices, and the clerks put on their great coats, although the air was at 67° Fah'r. There is no doubt that where Gas was used, the temperature was from 90° to 95°, and that therefore compared with these temperatures, 67° was cold.

All the large Electric Light Companies have applied to Parliament this year for Bills to give them power to open streets and to lay and suspend their wires; and there is no doubt that all these Bills will be referred to a Select Committee and that probably power will be given them to arrange with local bodies, such as Corporations of Towns and Boards of Health, for the breaking up of streets and the suspension of wires.

W. H. PREECE."

LONDON, February 6th, 1882.

No. 10.
JUNE 5, 1882.

TENTH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the Vice President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

NEW YORK, June 5th, 1882.

PROGRESS MADE IN THE FIRST DISTRICT, NEW YORK CITY. The last Bulletin brought the work in the First District down to the middle of May. Since then additional intersection safety-catch boxes have been put in, and there has been satisfactory progress in laying the remaining subterranean conductors. The central station building on Pearl Street has been connected with the mains and feeders running along the street in front of it, the details of the plant in the building itself have been nearly completed, and a competent engineer has been employed to take charge of the boilers and the engines. A full account of the progress made during the month of May will be published in the next number of the Bulletin, and soon after we hope to be able to announce, that we are ready to start the light in the First District.

MILAN, ITALY. Two steam dynamos, similar to those in the Pearl Street Station in this city, have been ordered for a central

station in Milan. The plant in the Cafe Biffi, heretofore mentioned in the Bulletin, is still running with success, and a number of orders for other plants have been received.

PLANT AT McKEESPORT, PA. The McKeesport *Times*, May 9th, contains the following account of the Edison isolated plant, burning in the works of the National Tube Company:

> "The beauty of the lamps is not only in the matter of economy, but a noticeable absence of heat and no danger from fire. We were shown through the coupling department, where the lights were burning, and noted the contrast, or difference, between the electric and gas light. One of the workmen in answer to a question, said: "With the electric light I am in no danger of having my face or whiskers burned, am free from dust and heat, and the light is a great deal stronger than the gas." A shade can be attached to the burner and be used upside down, if wanted, just as well as if put on the other way, and the heat does not affect the shade in the least. By means of a safety catch, all danger from fire is obviated, and should anything become wrong with one of the lights, it will in no way affect any other on the same circuit. The brackets can be swung the same as those used by gas companies, and can be placed to suit the convenience of the person using them; by means of a switch any number of lights are cut off that are on."

BUDA-PESTH, HUNGARY. The Post Office in that city is now being successfully lighted with a small Edison plant, superseding the arc light.

HAVANA, CUBA. The Edison plant now illuminating the Louvre is giving entire satisfaction. *La Nacion*, one of the daily papers, in its issue of May 15th, spoke of the starting of the light as follows: "Last night the Cafe of 'El Louvre' was illuminated with electric light. The result could not have been more satisfactory and public opinion has shown its appreciation of the new light by unqualified praise." *El Diario de la Marine*, another daily, said: "The exhibition last night of Edison's Electric Light in the cafe 'El Louvre,' as well as of the central station, was a brilliant success. In both places a great crowd moved to and fro eager to contemplate this

progress of science, which for the first time was exhibited to our public in such admirable perfection. The light is very clear and pleasant to the eye, and develops so little heat that the globes can be held in the hand for a long while without experiencing any burning sensation. The lamps at the Louvre remained lit until after midnight without the slightest interruption or the slightest unfavorable accident. The trial could not have been more satisfactory."

NAMES OF OUR DYNAMOS. The Edison Machine Works is making six sizes of dynamos. We give below the capacity and names of these several machines. Our agents will please be careful hereafter to designate the machines by their correct names.

15	light	or	E	Dynamo
60	"	or	Z	"
125	"	or	L	"
250	"	or	K	"
500	"	or	R	"
1200	"	or	C	"

It should be understood that the capacity as above given is for A or 16-candle lights, and that in each instance the dynamo will generate current for double the number of B or 8-candle lights.

WEED, PARSONS & CO. A plant of 120 B lamps, to be run by a Z dynamo, is being installed in the printing house of Messrs. Weed, Parsons & Co., Albany, N. Y.

RECENT ENDORSEMENT FROM THURBER'S. The following is an extract from a recent letter written by Messrs. H. K. & F. B. Thurber & Co., New York City, to business friends in another city who were thinking of introducing the Edison Light and who wished to know what Messrs. Thurber & Company thought of it.

The estimation in which they hold the light is shown by the following extract from their letter:

> "We take great pleasure in recommending the Edison system of lighting. We have now in use two dynamo machines, 60 lights each, in our store, at Reade, West Broadway & Hudson Sts. We have also adopted the system at our factory at Moorestown, N. J., and taken altogether, we consider it the most economical and satisfactory system of lighting we have ever seen, and as such give it our hearty endorsement. Yours truly,
>
> H. K. & F. B. THURBER & CO."

INJURIES FROM GAS JETS. The *Scientific American*, May 13th, 1882, contains the following article on "Some of the Beneficial Effects of Electric Lighting":

> "An English writer, after describing the baneful effects of gas lamps upon the healthfulness of living rooms, goes on to notice some of the mischief done to books, wares, furniture, and the like. The evil effects of the heat of gas jets is augmented, he says, by the large amount of water produced by the gas flame. Sixty burners will produce on the lowest computation two gallons of water per hour; hence in a November evening many large shops filled with delicate goods will have a nine gallon cask full of water thrown into their atmosphere in the form of steam, to condense on any cool surface, as we often see it trickling down the windows in winter. But worse remains behind. The sulphur, always present in gas in larger or smaller proportion, according to the character of the coal employed, burns into sulphurous vapor, which passes in the air to the state of oil of vitriol. The eminent chemist, Dr. Prout, exposed water in a drawing room in which gas was burnt, and found that it absorbed sufficient of these vitriolic emanations to redden blue litmus and show the presence of free sulphuric acid. The fumes from gas will indeed, in the long run, discolor every sort of fabric, rust metals, rot gutta percha, and reduce leather (as in the bindings of books) to "a scarcely coherent powder with a strongly acid taste." After referring to the evidence of the librarians of the Atheneum Club, London Institution, etc., as to the rotting of the bindings of books kept in rooms lighted by gas, the writer says: Drapers know to their cost how the edges of pieces of dyed fabrics become faded and rotten when kept long on the upper shelves of gas lighted shops; no plant will grow in a room where gas is burning, and cut flowers quickly wither; while those who work long and habitually in gas-lighted rooms become blanched and sickly. From all these manifold evils electricity will deliver us."

AERIAL CONDUCTORS VETOED IN CHICAGO. Mayor Harrison, Chicago, sent a veto message to the City Council, May

8th, vetoing an ordinance passed May 1st, allowing electric wires to be run on poles. The Mayor thinks the wires should be placed underground. The veto of the Mayor was subsequently unanimously sustained by the Council.

BRUSSELS, BELGIUM. An Edison isolated plant of 120 B lights is now being installed in the Musée et Passage du Nord. The installation is part of the Museum and is in a new stone building erected on one of the principal streets of the city.

THE WESTERN EDISON LIGHT COMPANY, CHICAGO. In a future issue we will give full details of the organization of the new Edison Company in Chicago. The *Chicago Tribune*, May 28th, contains the following notice:

> "The Western Edison Light Company completed its organization yesterday, and the indications are that the incandescent light of the Edison system will soon come into general use in Chicago and the West. This light is adapted to the lighting of houses, and is distributed and used through fixtures resembling the ordinary gas fixture. It has not the pallor of the large electric lights used in the streets, but is of an agreeable color. The Directors of the company are Thomas A. Edison, of Menlo Park: Gen. Anson Stager, John B. Drake, J. W. Doane, Norman Williams, Edson Keith, John M. Clark, John Crerar, and A. F. Seeberger, of Chicago: ex-Gov. Samuel Merrill, of Iowa: and Z. G. Simmons, of Wisconsin, President of the Northwestern Telegraph Company, and among those interested in the company, it is said, are a number of prominent capitalists, including George M. Pullman, Marshall Field, Samuel Allerton, C. R. Cummings, and others. The operations of the company are not confined to Chicago, as it owns the exclusive use of the patents of Mr. Edison in all cities in the State of Illinois, Wisconsin, and Iowa. The company has rented the stores Nos. 51 and 53 Wabash avenue for its headquarters, and will immediately set up a plant there capable of lighting nearly the entire block. Already it has placed its lights in Marshall Field & Co's basement, retail salesroom, the Palmer House, the Republic Life building, and its wires are in several residence houses."

KING PHILIP MILL, FALL RIVER. We have received an order from the King Philip Mill, Fall River, to install an Edison

plant of 702 A lamps to light the new mill, the plant to be installed by the time the mill is finished, and to be in running order September 15th.

PROGRESS IN GREAT BRITAIN. The London Company is now in good working order, and local companies are being rapidly established, especially in England. Many orders have been received for plants, and they are being installed as rapidly as machinery can be procured and local organizations can do the work. Mr Johnson has promised us a list of all the plants thus far actually running, for an early number of the Bulletin. The Holborn Viaduct Central Station continues to run with entire satisfaction, and is generally recognized as a successful exhibition on a large scale of the practical working of the Edison system of incandescent lighting, both in houses and streets.

SMALL PLANT IN NEW YORK CITY. We are installing a small plant of 15 lights in the preserving establishment of Max Ams, 372 Greenwich Street, New York City.

THE ELECTRIC LIGHT CURES SHORT-SIGHTEDNESS. The London *Engineering*, February 17th, 1882, refers to an article contributed by Prof. W. H. Pickering, Massachusetts Institute of Technology, Boston, to the London *Nature* February 9th, 1882, entitled "Concerning the Gas Flame, Electric Light and Solar Spectra, and their Effects on the Eye." The following extract is from the article in the *Engineering:*

> "Remarking the number of students who are afflicted with short-sightedness, Professor Pickering has lately examined some physical causes that may bring about this abnormal condition of the eye. He finds that it is not the light so much as the heat that is mainly concerned in developing the prejudicial effects. Heat is radiated from the flame of the lamp and chimney, and is reflected from the shade and the surface of the paper. It immediately alters

> the hygrometic conditions of the surrounding air and dries the forehead, temples and eyes. This view seems to be confirmed by the fact that temporary relief from headache and pains in the eyes may be found in bathing the affected organs with fresh water.
>
> Ordinary gas burners and oil lamps give out a considerable amount of heat by the energetic combustion of the hydro-carbons and hence their injurious effect. In this respect the electric light is not open to the same objection, for although the light may be rendered as intense as desirable, still there is but very little heat produced. The flickering which is especially noticed when the arc is employed, is certainly a draw-back, but this, it is hoped, will be ultimately remedied. Almost perfect steadiness is already attained in the incandescent lights."

ANTWERP, BELGIUM. An Edison isolated plant of 45 A and 40 B lamps is now running in the Sugar Refinery of Gits, Segers and Co., the largest of its kind in Belgium. The plant runs from six at night until six in the morning. It has given great satisfaction and in consequence the firm desires another factory lighted with about 300 lights.

THE ORANGE WOOLEN MILL PLANT. Our lights have now been burning in the Orange Woolen Mill, Newburgh, since last September. Mr. Harrison, the proprietor, informs us that some of his lamps have been burning over 1,000 hours, actual burning, and are still alive. He is highly pleased with the plant, and states that the dynamo gives him as little trouble as any machine in his mill.

CAUSES OF FIRE. A number of the leading insurance companies of London have been trying to discover the causes of fires which occur in dwellings. The *Fireman's Journal* says: "It is estimated that twenty per cent of such fires in cities are the result of gas or other light coming into contact with curtains or window blinds."

EDISON'S STEAM DYNAMO. Mr. C. L. Dean, Superintendent of the Edison Machine Works, under whose charge the Edison

dynamos are built, furnishes the following items of the weight of the entire steam dynamo and of the principal parts of it. Attached to each dynamo and mounted on the same bed plate, so that it forms an integral part of the steam dynamo, is a steam engine of 125 H. P. and capable of being driven up to 200 H. P. Each of these dynamos has already developed, by actual test, 1,750 lamps of 16 candle power. The total weight of each dynamo is 60,336 lbs, and the weight of the different parts of the dynamo are as follows:

Bed Plates	10,337 lbs.
Zinc Bases	677 "
Fields	16,372 "
Cores	6,044 "
Keepers	6,300 "
Pillow Blocks	671 "
R. Arm	125 "
Armature	13,310 "
Engine	6,500 "
	60,336 lbs.

WORUMBO COMPANY. We have received an order to install a plant in one of the mills of the Worumbo Manufacturing Company, Lisbon Falls, Maine. The installation will be made at once.

UNDERGROUND CONDUCTORS. The report of the Sub-Committee of the Committee on Cities of the New York State Senate, relative to underground conductors, together with the testimony taken by the Committee, has been published by the Legislature under date of May 3rd, 1882. The following extracts are taken from the report:

"The important question to which your committee have directed their inquiries, is the practicability or rather the feasibility of placing all electric wires underground. They fully recognize the importance of preserving to all

the companies the full measure of their usefulness, and of not imposing upon any of them unreasonable burdens. They have kept in mind the immediate and future breaking up the surface of the streets, an evil not so serious when we consider that as many as 800 wires can be placed and worked in an 8-inch tube, the question of the practical and continuous working of subterranean wires, as well as their relative cost, value and convenience to their owners, as well as the public, and they believe that they have considered and weighed all the elements of the inquiry necessary to a safe and intelligent conclusion. In this investigation they have examined more than twenty witnesses, most of them experts in the use and application of electricity—some of them certainly the most thorough and accomplished experts in the country. These gentlemen represent the opponents as well as the friends of the proposed bill. One was the electrician of the Western Union Company, others were connected with other companies, and the committee invited by public announcement and private invitation all who could aid the inquiry to present themselves for examination. The testimony of these witnesses is herewith presented. In the opinion of your committee, it establishes, beyond controversey, the entire feasibility of subterranean wires, for telegraphic, telephonic and electric light purposes, and shows it to be the duty of the present Legislature, so far as our larger cities are concerned, to provide by law for the prompt commencement of the work of putting these wires underground, and for insuring the removal of the posts and wires from the streets of such cities within the next two years and six months. It is a noteworthy fact, that among all the experts examined in the city of New York, there was not one who could testify unreservedly against the feasibility of subterranean lines at the present time. * * * The committee recommend that the growth of the evil be promptly and definitely arrested, and the construction of new lines or the erection of posts in any of the streets to which the bill applies, be declared so clearly unlawful as to justify their destruction by any individual who may choose to remove them. They also recommend that the corporations be required to remove all the posts, or other fixtures from all the streets, avenues and highways in such cities, within two years and a half, a length of time which the committee believe to be amply sufficient for the change."

BERLIN, GERMANY. A central station, modelled on the Holborn Viaduct Station, London, is being installed on the Unter den Linden, Berlin. They will use two of the Edison mammoth steam dynamos, similar to those used in our Pearl Street station in this city.

PUBLIC LEDGER, PHILADELPHIA. The plant just installed in the office of the Public Ledger, Philadelphia, is giving good

satisfaction. The following extracts are from the issue of that paper, May 18th:

"On Tuesday and Wednesday nights the composing room of the PUBLIC LEDGER office was lighted by means of the Edison incandescent light, which proved a very satisfactory substitute for gas, both on account of its illuminating power and of its agreeable character as compared with gas, in that the incandescent light does not heat or vitiate the atmosphere. The electric light is furnished by what is known as a 60-light dynamo machine erected in the press room. * * * The conducting wires, heavily insulated, are from the basement to the fifth story in the grooves of a flat board fastened to the wall, the grooves being covered by a lid screwed on after the wires have been put in place. On the main and all branch circuits are "safety catches," consisting of lead wire interposed in the circuit; the design being that if from any cause the current becomes too strong and threatens to heat the conducting wires, the lead wires shall be melted and the connection broken, thus removing all danger. The wires are carried overhead on several circuits above the compositors' stands, and down through gas pipe "drops" to swinging brackets, very similar to ordinary gas fixtures, but terminating in a screw socket, in which the lamp is to be fastened. The fixtures, are in all respects the equivalents of gas fixtures, and the light is turned on and off from each lamp as with the gas by means of a simple key. The lamps used are of two sizes, one rated at 16 candle power, the other at 8 candles. * * * There are sixty-five lamps of sixteen candle power in the composing-room and stereotyping foundry, and sixteen of eight-candle power, besides one of sixteen candle power in the press-room, making a total equivalent of seventy-four of sixteen-candle power. Although the dynamo machine is rated as a sixty light machine, it furnished a satisfactory light from all these lamps on Tuesday evening, and there was still some reserve power, a part of the resistance coils being in circuit. The lamps are hung with the bulb downwards, so that there is nothing to hinder the light from falling directly on the compositors' cases. They have over them white glass shades, like those of argand burners, which greatly help the light by concentrating it. The trial so far has been entirely satisfactory, so far as the electrical features of the light are concerned. It is too early yet to speak of the economy of the system. That will depend to a greater or less extent on the lifetime of the lamps."

LIGHTING STEAMERS IN RUSSIA. A firm of Russian merchants who have a fleet of steamers plying on the river Volga during the summer, are having one of their vessels fitted up with 120 Edison 8 candle lights. If this experiment prove satisfactory, the light will be introduced on the whole fleet.

E. & T. FAIRBANKS & CO. We are installing a plant of one Z dynamo, 60 A lamps, in the scale works of E. & T. Fairbanks & Co., St. Johnsbury, Vt.

VINA DEL MAR, CHILI. We have received a letter from Mr. Lawrence, the engineer in charge of our isolated plant at Vina del Mar, informing us of the continued success of that plant. The letter states that everything appertaining to the machine and lights has worked well and given entire satisfaction from the start. There are 58 lights in the hotel, supplied by 3,750 feet of conductors, besides 2 A and 4 B lights run over 1,300 feet of conductors in the house of Mr. Kendall, some distance away.

MILWAUKEE, WISCONSIN. A small plant has been ordered from the Isolated Company for the store of Mr. John Hinkle, Milwaukee, Wisconsin, and is now being installed.

RAILWAY STATION LIGHTED AT RIO. We have received a report, dated May 4th, about our plant burning in the Dom Pedro Railroad Station, Rio de Janeiro, Brazil, stating that the lights up to that time had been burning 78 days, aggregating 338 hours, with a loss of only seven lamps. The lights are arranged as follows; 6 at the entrance of the station, 8 in the Waiting Room, 5 in the Director's Room, 2 in the Ladies Waiting Room, 37 in the Shed or depot proper, and 2 in the engine room, making a total of 60. The Commission appointed by the Government has examined the light and made an official report, showing a result much better than we had represented.

PALMER HOUSE, CHICAGO. Our plant continues to run well in this hotel, and the proprietors say nothing better could be desired. In the large dining room we have 60 lamps placed on the gas fixtures

by special attachments, and in the small dining room there are 36 lamps placed in the same way.

THE ENGLISH PRESS AND MR. EDISON. The present attitude of the English press towards the Edison light is very gratifying. English journals of all kinds are filled with long accounts of the success of our light at the Crystal Palace and of the starting of the Holborn Viaduct Station in London. The very papers that used to ask, "*Why does not Edison do something?*", are now themselves furnishing the answer to their own question, namely, that he always has been doing something, and that, instead of going before the public with a fragmentary invention, as other inventors have done, he has been patiently and thoroughly developing an elaborate *System* of electric lighting. That system is now in practical operation in London at the Holborn Viaduct, and the unanimous tribute paid to its success by the British press is the best possible apology for the ignorance heretofore displayed in the oft-written taunt that it was "time Edison was doing something." A recent letter from a prominent electrician of the English Edison Light Company, speaks as follows of the present attitude of the British press:

> "Not many months ago Edison was being ridiculed and sneered at by nine-tenths of the technical and daily press, but to-day there is not a paper in all England of any sort or character, which does not squarely admit that Edison has proven by his work here that all his promises have been fulfilled, and that he is far and away in advance of all competitors. Less than a year ago none were so poor as to do him reverence, while now none are too high or too rich."

No. 11.
JUNE 27, 1882.

ELEVENTH BULLETIN.

The Edison Electric Light Company,

65 FIFTH AVENUE.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the Vice President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

New York, June 27th, 1882.

OFFICE TO BE CLOSED EVENINGS ONE WEEK. The office of the Company, No. 65 Fifth Avenue, will be closed evenings during Fourth of July week. Our agents will please bear this in mind in making appointments to be kept at this office during that week.

PROGRESS IN THE FIRST DISTRICT, NEW YORK CITY. The Ninth Bulletin contained a detailed account of progress made up to the end of April. During the month of May, 7,923 feet of street underground conductors were laid, including mains on the block fronts, street intersections, bridge intersections, and feeders. In May there were 24 working days. Most of this time was spent in putting in safety-catch boxes and street intersection safety-catch boxes. There were 37 of them laid in 20 days. Three days were allotted to putting in mains and feeders upon the block fronts, and at intersections, and one day was given entirely to bridges with

their safety-catch boxes, a class of work which was also continued from time to time in connection with the other underground conductors. Fifteen house connections were made between the conductors in the streets and houses already wired for our light. During this month all the remaining intersection boxes have been put in, and all the street mains have now been laid except at Fulton Market, with which exception, and with the exception of a few bridges, the work of laying the underground conductors is now entirely completed.

PHILADELPHIA. THE LEDGER PLANT. The light in the Ledger building has proved so satisfactory that a larger plant has been ordered. Pending the change to the new plant, the light was temporarily stopped, but the compositors, when thus obliged to return temporarily to the use of gas, sent a committee to Mr. Childs requesting that the Edison light be restored as soon as possible.

WIRING OF THE MILLS BUILDING, NEW YORK CITY. The Mills Building, Wall and Broad Streets, has been wired for 5,588 Edison lamps. As this is the largest enterprise of the kind ever undertaken, the details may prove interesting. The conductors consist of 1,650 feet of Edison's patent electric tubes, 628 feet of lead pipe containing taped wires thoroughly insulated, 23,658 feet of Zinc tubes, 75,909 feet of wire conductors, and 24,162 feet of wooden receptacles, placed between the floors, to hold the system of distributed wires. The total amount of wire used was 3,774 lbs., besides 48 vertical main cut-outs, and 253 division cut-outs. The work was done by the wiring department of the Edison Illuminating Company of New York, under contract with Mr. D. O. Mills, the owner of the building.

BOLOGNA, ITALY. The installation of a plant has just been completed in the flour mill of M. Pasifico Cavaliére.

EDISON LAMP COMPANY. NEW FACTORY. The moving of the lamp factory from Menlo Park to East Newark affords a fitting occasion for making a brief mention of the history of the Edison Lamp Company. The manufacture of lamps was commenced at Menlo Park, in November, 1880. Prior to that date, a large number of lamps had been made, but the first regular pay roll of the Lamp Company, as an organization distinct from the laboratory and the experimental department of the Light Company, was November 11th, 1880, which may be taken as the date of the starting of the factory. From that time until April 1st, 1882, when moving to Newark was commenced, the factory was running all the time, except about six weeks. The largest number of men employed at any one time was 135, and for the last year there has not been at any time less than 100 hands employed. Up to April 1st, 80,000 lamps were shipped, and at that time there were about 50,000 unsold in stock. The reason for moving the factory to East Newark, is to secure larger buildings, with increased facilities, also convenient accommodation for workmen, and to be nearer the source of supply for obtaining reliable help. The manufacturing of lamps was begun in the new factory at East Newark on the first of June, 1882, and 150 men are now employed. The tools and power now in the factory are adequate for making 1,200 lamps a day, but the factory has an ultimate capacity of 40,000 lamps a day, which will require from 3,000 to 4,000 hands, according to the style of lamps made. The lamp factory has always been managed with unusual skill and intelligence, and all visitors have united in praising the perfection of the system and the economy and precision of the work. The Officers of the Edison Lamp Company are as follows, viz: Thomas A.

Edison, President; Francis R. Upton, Treasurer; William Holzer, Superintendent; and J. J. Bradley, Master Mechanic.

ITALY. ADDITIONAL PLANTS INSTALLED. A plant is now being installed for Monsieur Crespi, Director of the National Bank, in Milan, in a factory near Milan. Another plant is being introduced in the cotton spinning mill of M. Punti, also near Milan.

CORNWALL, PA. Mr. R. H. Coleman is now using one of our isolated plants at his anthracite furnace. The plant consists of one Z dynamo and 60 lamps, and the light is used in the smelting and engine rooms, also in the office which is situated nearly 500 feet distant from the dynamo.

PHILADELPHIA. THE STETSON PLANT ENDORSED. We have received the following letter from Messrs. John B. Stetson and Co., Hat Manufacturers, expressing their satisfaction with the Edison isolated plant now in use in their factory, No. 1,746 North Fourth Street, Philadelphia:

"PHILADELPHIA, June 21st, 1882.

"To the EDISON COMPANY FOR ISOLATED LIGHTING:

"In answer to your inquiry of today, we would say that we are entirely satisfied with the Edison light, and in regard to the half lights in our sewing department we cannot speak too highly of them. We are using them on black work mostly. The operators are especially pleased with the absence of heat and flickering.

"Very respectfully yours,

"JOHN B. STETSON & CO."

MR. JEHL ON THE EDISON METER. Mr. Francis Jehl, formerly connected with Mr. Edison at Menlo Park, has published in London, for the benefit of the Edison Company in London, with which Mr. Jehl is temporarily connected, an interesting pamphlet on the Edison Electric Meter. Any stockholder especially desiring a

copy can secure one by addressing Mr. Francis Jehl, The Edison Electric Light Company, Limited, 57 Holborn Viaduct, London, England.

HAVANA. THE LOUVRE PLANT. The Edison plant illuminating the Louvre continues to create a marked sensation. There are 58 A lamps on 17 chandeliers and 8 B lamps on one chandelier, also 4 B side lights connected in series, making a total equivalent to 64 A lamps. The Edison lamps are arranged on the gas chandeliers so that gas and the electric light can be used either separately or together. By simultaneously shutting off the gas and putting on the electric lights, an effect is produced which is highly appreciated by the patrons of the Louvre. The current, generated in a building 500 feet distant, is conveyed by underground conductors consisting of size No. 4 Edison Electric Tubes, laid 15 inches under the surface of the ground. In addition to the illumination at the Louvre, a display of 60 lamps is made at the office of the Edison company, where are also displayed hand lamps, bracket lamps and a large outdoor globe containing 10 lamps, also a motor (⅙ H. P.) driving a sewing machine. The entire plant is driven by an 8 x 10 automatic cut-off engine, running 150 revolutions per minute with 60 lbs. boiler pressure and an average steam pressure on piston of 40 lbs.

BUDA-PESTH, HUNGARY. The General Telegraph Office is now lighted with a plant of 60 A lights. There are six lamps in the public office, a few on the staircase, and the rest are in the large telegraph operating room.

ARLINGTON MILLS, LAWRENCE, MASS. With reference to our plant running in the Arlington Mills, Mr. Hartshorn, the Superintendent of the mills, states that the quality of the Edison light

"is undoubtedly superior to the gas light either past or present." He further writes that the dynamos have worked well, with no greater consumption of power than was guaranteed, and that he has never had occasion to stop them while in use, from any cause whatever. He adds that the company are "much pleased with the appearance of the light and are satisfied with its performance."

BERLIN CLUBS TO BE LIGHTED. Plants have been ordered for two Berlin Clubs, namely, La Ressource and l'Union.

ANTWERP, BELGIUM. A plant of 60 lamps has been installed in the Hotel de Ville.

SARREGUEMINES, LORRAINE. A plant of 60 A Lights has recently been started in the factory of the Porcelain Manufacturing Company, the largest of its kind in the world, employing 3,500 hands. One fact of especial interest in connection with this plant is, that 20 Edison lights are used in the painting room, where the porcelain is decorated, thereby enabling the decorators to work at night.

LONDON. SPECULATION IN LIGHT STOCKS. The London papers continue to refer to the great speculation raging in that city in stocks of electric light companies. It is a source of gratification to us to know that no stock of the parent Edison company, in London, is on the market, the entire stock having been taken by a limited number of large capitalists, who will hold it intact until the system shall have been thoroughly exploited and its financial success assured. Mr. Labouchere, in an article in *Truth*, May 25th, after commenting in very severe terms upon the questionable methods adopted by certain light companies to float their stock upon the London market, makes an exception with reference to the antecedents of Mr. Edison, of whom he speaks as follows:

"The most practical of electricians is, I think, Mr. Edison. * * * Electrical lighting will, I have no doubt, eventually replace gas; and if I had to pin my faith upon a man in respect to a system, it would be upon Mr. Edison. * * * Why I have alluded favorably to Mr. Edison is because he seems to be the most practical man connected with electric lighting; I neither believe nor disbelieve in his lamps and dynamo machines, but I think that, because he is a practical man, and because he has much skilled knowledge in connection with electricity, he is more likely than his competitors to succeed in giving us a perfect system of electric lighting based upon the essential requirement that the light will be as cheap or cheaper than gas."

BOSTON. VENDOME HOTEL. We are installing a plant of 60 lights in this hotel. About 50 lights will be distributed in the dining room and about 10 additional lights in the offices.

NUMBER OF LAMPS IN ISOLATED PLANTS IN THE UNITED STATES. The business of the Isolated Company amounts thus far to 67 isolated plants, aggregating 10,424 lamps. There are 4,920 A lamps, and 5,504 B lamps, making the total number of lamps 10,424 in isolated plants in the United States alone. The business is rapidly increasing and the indications are that in the Autumn when the days begin to grow short the utmost energies of the Isolated Company will be taxed to fill orders.

STEYER, AUSTRIA. An installation of 45 A and 32 B lamps has just been made in the machine shops of the Oestereichische Waffenfabrik Gesellschaft. Our dynamo is run by water power, and the plant is giving great satisfaction.

JERSEY CITY. We have just lighted the sugar refinery of Messrs Mattheissen & Weichers with two Z dynamos and 300 B lamps. This firm had tried several systems of lighting by electricity, but none had proved satisfactory until ours.

MILAN, ITALY. The following is a translation of a letter addressed to Mr. Shepherd, connected with the Edison light in Italy, relating to the successful introduction of the light in Milan:

(TRANSLATION.)

"MILAN, March 28th, 1882.

"JAMES SHEPHERD, Esq.,
"MILAN.

"The experiments of incandescent electric lighting (Edison system) carried out by you for over 20 nights in the largest Foyer of the Scala Theatre here, succeeded in a manner so satisfactory as to arouse the most general admiration. All those persons who had the opportunity of assisting at these most successful experiments, carried away with them the thorough conviction that the wonderful invention of Edison marks a gigantic progress in the difficult problem of lighting by electricity, and that very little was now left to arrive at the desired perfection. The Municipal Council of the city of Milan, Italy, glad to be in a position to make publicly known to the citizens this miracle of science, and happy to be in position also to corroborate the exactness with which the above experiments were arranged and carried out by you, have the greatest pleasure and most lively satisfaction in testifying and informing you of its satisfaction, and enclose you the present as a testimonial of the splendid success of the above experiments.

"With all esteem,
"The Mayor of the City of Milan,
"BELINZAGHI."

THE THURBER PLANT AGAIN. The following letter from H. K. & F. B. Thurber & Co. speaks for itself:

"NEW YORK, May 27th, 1882.

"THE EDISON CO. FOR ISOLATED LIGHTING,
"New York.

"GENTLEMEN:—Now that the installation of your light in our building has been completed, we take pleasure in informing you that the light as now used gives us entire satisfaction. We find that it can be readily controlled by our engineer and, in short, that so far as our experience goes, it seems to meet all the requirements which you claimed for it.

"Yours very truly,
"H. K. & F. B. THURBER & CO."

CHICAGO. PLANT IN THE NATIONAL LIFE BUILDING. A plant of 60 lights was started May 18th, in the National Life

building. Many lamps are used during the day, and the tenants express themselves as delighted with the light.

STEAMSHIP QUEEN OF THE PACIFIC. This new steamship, belonging to the Oregon Railway and Navigation Company, is lighted throughout with the Edison light, except the hold and pilot house. There are in all 246 B lamps, of which 12 are of 16 candle power, and the balance of 8 candle power. There are 2 Z dynamos driven by direct belt connection with the engine. The lamps are so arranged that any individual lamp or section of lamps may be lighted or extinguished at pleasure, all switches being placed under control of the steward. One switch controls all lamps forward of the engine room, another all the lamps in the steerage, and the balance are divided among the staterooms, offices, engine room, saloon, dome, shaft alley, &c. The wires are all carefully concealed from view, and yet are easily gotten at for the purposes of repairs and addition. On the trial trip every lamp came up perfectly, and entire satisfaction was expressed by all. The following description of this installation is taken from a recent number of the *Nautical Gazette:*

"The *Queen of the Pacific* is lighted throughout by the Edison Electric Light system, and she is the most perfectly lighted of any vessel in the world, there being about 250 electric lights distributed through the ship, with connections for placing lights on the wharves at her loading and discharging ports on her route. * * * These lamps are screwed into a socket in the ceiling of each stateroom, water closet, the butcher's shop, mess room, engine and boiler rooms, shaft alley, all the officers' rooms, crew's quarters, steerage, galley, pantry, passage way, 'glory hole,' etc. These lights are so arranged in groups that the steward can turn off the lights in the state rooms, the saloons, in the dome, or in fact, any section of his department at will, or can turn on or off any individual light. In the officers' rooms, or the engine department, each light is manipulated at will or as a whole as desired. There is absolutely no danger from heat, fire or explosion in this system. The "safety-catch" precludes the possibility of fire. For lighting steam vessels this light is cheaper, cleanlier and safer than any other means of illumination. The steamer *Columbia* of this line was fitted with the Edison light in 1879, and the success of the system has been very marked. She had 115 lamps in circuit in Febru-

ary last, and they had been run over 415 hours, without even one lamp going out, the expense being, for the 115 lamps, with coal at $6 per ton, only 18 cents per hour. The *City of Worcester*, of the N. Y. & Norwich Line, is also fitted with the Edison lights. The *Queen of the Pacific* has two dynamos run by an 18 horse power (nominal) engine, while the average power to light the vessel is about 10 horse. One of the beauties of this system is that no special engineer or electrician is required to attend the machinery, and it only requires a few minutes attention daily for oiling, etc. One of the special features of this system of lighting is, there are no smoky lamps, the windows and doors of staterooms and saloons can be kept open, where, with ordinary lamps, they would have to be shut, with a great saving in breakage of chimneys, globes, etc."

THE "INSURANCE TIMES" ON THE FIRE QUESTION. Mr. English, in the last number of the New York *Insurance Times*, states that he is informed by Mr. Anderson, the Chairman of the Committee on Police and Origin of Fires, of the New York Board of Fire Underwriters, which has been examining into the dangers of fire from the use of electric light equipment and has prescribed rules for wiring buildings, that the Board of Underwriters "have no record of any accident to life or property caused by the use of electric lights where the entire equipment was in full compliance with the New York Standard." These rules have now been in operation for six months, and the fact that there has been no fire and no accident, shows not only that electric lighting is safer than gas, but that it is well nigh absolutely safe.

MANCHESTER, ENGLAND The following notice of the plant now running at the Salford Iron Works, is taken from the *Manchester Weekly Times*, May 20th:

"The Edison electric light has been applied to practical purposes for the first time in Manchester in the workshops and offices of Messrs. Mather and Platt, the proprietors of the Salford Ironworks. Two dynamo machires of the combined strength of 120-light power, but which can be worked to 300-light power, produce an electric current for 134 lamps, each giving a light equal to 16 candles. The machines are driven by a single-cylinder steam engine of six-horse power nominal, and the mains are carried from the machines to all

parts of the building. In the workshops there are 80 lamps, and in the offices 54. Each lamp can be detached from its bracket and carried about the room, care being taken that the connection with the wires is not stopped. The light given out is very steady, and greatly exceeds the ordinary gas jet in brilliancy. The workmen prefer it to gas, as the electric lamp is more easily handled, no smoke or heat is given off, and it can be held in any position. * * * Some of the lamps are temporarily fastened to the ordinary gas brackets, while others are affixed to a bracket which has been invented by Mr. Edison, and which allows the lamp to be turned and twisted in any direction without the electric current being broken. The Edison incandescent lamps are distinguished from all others by their lasting power. They have been tested to stand a continuous strain of 1,000 hours, incessant burning, but if 500 hours be taken as the average time per annum required for lighting offices, &c., each lamp would last from one to two years. No danger from fire or accident can arise in this system. * * * The conductors may be held in the hand with impunity even while the full current is passing. * * * It is the intention of Messrs. Mather and Platt to do away with gas in the whole of their establishment and use only the Edison electric light. When this is done there will be over a thousand lamps in operation from the same source."

SECRETS OF OUR LIGHT SYSTEM. A prominent stockholder has recently enquired whether any secrets of the Edison System of Lighting are known exclusively to Mr. Edison, or whether all the secrets and details of the business have been communicated by him to the company. We are somewhat surprised that such a question should be asked, as it has been repeatedly stated that Mr. Edison has turned over to the Company, not only all his inventions and patents, but also all the details of construction and use concerning them, including what are commonly known as the secrets of the Edison System. In the case of foreign companies, notably the French Company, where everything without exception must be manufactured in France so as to conform to the French patent law requirements, not only were the leading principles of the Edison System and of the processes of manufacturing reduced to drawings and to writing, but all the details and secrets of the system were fully written out by Mr. Edison himself, and sent to Paris, so as to enable the French Company to start its manufactures and to introduce the Edison System of

lighting with the same skill and success as here. The same thing is about to be done in the case of other foreign countries. Thus it will be seen that the apprehension of our stockholder is unfounded. We are, however, gratified to receive the enquiry, and take this occasion to ask our stockholders always to ask any questions touching the affairs of the Company they may wish to. We will reply cheerfully.

DANGER FROM GAS. William Meakin and his wife arrived in this city on May 31st by Cunard Steamer, Batavia, registered at the Eagle Hotel, Morris Street, and retired. About noon next day they were called but no answer being received the door was broken in and they were found in bed insensible. The apartment was filled with gas which was streaming from the burner. Both died within two days from the effects. * * * A guest who arrived at French's Hotel, May 21st, and registered as P. R. Covert, Providence, R. I. retired to bed late in the evening. At noon an employee of the hotel found him insensible. Medical aid was summoned but the man died at one o'clock P. M. Death was attributed to suffocation by gas. * * * Mr. C. C. Potter, clerk in the Water Registrar's Office at Fall River, was about to take the reading of the water meter at the Border City Mill No. 1, when a gas explosion occurred, whereby he was quite seriously burned. The water meter is under ground in a niche or opening. Mr. Potter took a light, and was putting his head in the niche when the explosion occurred. A subsequent examination showed that the gas from a leaky pipe had collected about the water meter. The force of the explosion was sufficient to throw some stone steps, which were near by, some 5 inches out of position, and to crack the top step. * * * The New York *Times* of April 27th, 1882, contains an item to the effect that John Ham, a Chinaman, blew out the gas in a room he occupied in the Van Dyke

House. He was found insensible and taken to the hospital. * * * A gas jet in the drying drum used in the mirror manufactory of Heroy & Marrenner at 110 Duane Street, was not entirely turned off on the night of April 26th, and when Robert Cookson went to light it on the following morning an explosion followed which badly burned and bruised him.

CHICAGO. ADDITIONAL HOUSES TO BE WIRED. In addition to wiring the residences mentioned in the Eighth Bulletin, we are also wiring those of Thomas Dent and James R. Jones, for the Edison light.

MEASURING CANDLE POWER. The following is taken from an article on the *Age of Electricity*, by W. H. Preece, F. R. S., appearing in the London magazine, *Time*, of May:

"This mode of indicating the illuminating power of any lamp is a subject very little understood and very much abused. The standard light with which all other lights are compared is a sperm candle, which burns away 120 grains per hour. Such a standard is a very useful unit when we wish to measure an oil lamp or a gas-burner, and to measure such lights the operation is a comparatively simple one. We simply have to find at what distance the standard candle and the lamp to be measured cast equal shadows. In that case we deal with lights of the same character, emitting the same kind of rays, and we are not troubled by any interference from colour or from other causes. But when we come to use the same standard to measure the electric arc, which emits rays of a totally different character to a gas lamp, we flounder in difficulties. The difficulties are so great that different observers measuring the same lamp have made it vary in light-giving power from 250 to 2,000 candles. I have proposed to abandon the standard candle as the unit by which the electric lights should be measured, and to take instead the amount of illumination distributed over a given area, say a square yard. This idea has not yet received adoption, though indications are given that some of our practical men are beginning to see its advantage. If, for instance, we take as a standard a square yard illuminated by a standard candle at one foot distance away, we should have a better unit to guide us than that now given by the flame of the candle. When we compare the relative intensity of different sources of light, we have not only to deal with the intensity of the light but with the volume of flame

given out by it. This is one source of the great discrepancies that are made by different observers."

RUSSIA. A plant of 60 A lamps has been running four months in the iron works of Nobel & Co., St. Petersburgh. A plant of 120 B lamps has been running nearly four months in the Life Insurance Company building, St. Petersburgh.

MR. JOHNSON BEFORE THE PARLIAMENTARY COMMITTEE, LONDON. The Select Committee of the House of Commons appointed to consider the merits of the various electric lighting schemes promoted before Parliament this Session by new lighting companies, gas companies and corporations, have recently examined Mr. E. H. Johnson, Mr. Edison's representative in London, on the general subject of electric lighting and on the special subject of the Edison System of electric lighting. The following account of Mr. Johnson's statement before the Committee is taken from the *London Standard*:

"Mr. Johnson said that the verdict of the Select Committee which had sat to consider the subject of electric lighting in 1879, was that the subdivision of the electric light was a dream. This, however, was not the fact. The conditions pre-requisite to a practical subdivision of the light, or more properly speaking, to a system of universal distribution of electricity, were the following:—Firstly, means for the manufacture of electricity on a scale commensurate with any possible consumption; secondly, means for the universal distribution of the electric currents over every portion of a given area; thirdly, means for regulating the pressure, and otherwise absolutely controlling the force of the current; fourthly, means for utilizing the current to effect the desired work, whether for producing light, heat, or power, or for any other purpose, and whether for the production of small or great units of work; fifthly, means for protecting life and property from any danger arising from the introduction of this new form of energy into our households; sixthly, means of measuring the amount of individual consumption, so as to obtain a correct ratio of the charge to the consumer; seventhly, means for establishing the individuality of each and every unit of light or other work, so as to render it absolutely independent of any other unit; eighthly, means for guaranteeing an ever-present and sufficient flow of current reliable at all hours; and ninthly, co-relating to all these were such

special general provisions in respect to every detail as would suffice to render the establishment of this new industry free from imposition upon the general public of any nuisance, either to the eye, ear, or other senses. These conditions had been established since the investigation of 1879. Electrical generating machines were now constructed capable of developing from 100 to 150 horse power of electricity, and they formed a unit of generation quite large enough to permit of a multiplication of their number sufficient for all possible purposes without encumbering the manufactory with a number of units which would render it unworkable. The condition of efficient distribution had been met, but the system to be adopted must necessarily be one of underground conductors. The various electrical conditions requisite to the successful installation and maintenance of such a comprehensive underground system had been provided, and their successful operation had been demonstrated; numerous devices for regulation were in present operation, and were all more or less practicable. As to the subdivision of tho electric current it was only necessary to point to the Paris and Crystal Palace Electrical Exhibitions to show that it had been fully accomplished. With regard to freedom of danger in the use of electricity, all the essential conditions of a general distribution for any purpose whatsoever might be met by the use of a current of such low potential as to be entirely inadequate to overcome the resistance of, and therefore to traverse, the human body. With regard to fire, the condition was met by the introduction of automatic devices based on the effect of heat on metals, and not upon mechanism, and, therefore, absolute in their action; which devices prohibited a rise of temperature in any part of the conductors, lamps, or mechanism sufficient to produce an abnormal heat, thereby preventing fire. As to measurement, various devices were in existence for measuring the amount consumed by each individual, all more or less practical, some of them being, in fact, superior in accuracy to gas meters. Individuality was effected in many ways, resting primarily on the establishment of a fixed standard of resistance to the flow of the electric current in each point of consumption. Various devices had been devised for delivering the electricity into reservoirs located conveniently throughout the district or upon the premises of the individual consumer from which reservoirs the electric current was redelivered to a standard point of consumption more readily obtainable than was that which was suitable for the reception of the current direct from its primary source. Then, in the matter of reliability, two practical methods for insuring the presence of the current at each and every moment of time, so as to be ever at the command of the consumer, were now in existence. All work in relation to electric lighting should be of such a character as to bear the closest scrutiny by an expert. He believed the art of producing light by means of electricity had now passed the experimental stage, and had become a *bona fide* manufacturing industry. * * * For the supply of the electric light advantageously very large works should be established, which works should in every detail be constructed and appointed with special reference to their utility for the purpose. There were numerous

special appliances which were absolutely useless except in connection with the manufacture of electricity on a large scale. * * * Comparing electricity with gas, there could be no doubt that when the electrical output approximated that of gas, the former would be by far the cheaper of the two; but in order that that desirable time should be hastened as much as possible, it was essential the operations of electrical lighting should be conducted upon the largest scale permissible by the present stage of its development. * * * In his judgment, electricity would shortly be utilized for producing power for manufacturing and domestic purposes to an extent which would, in certain sections of a large city, result in placing it in the first rank with respect to consumption, and relegating lighting to the second rank.

Cross-examined by Mr. Richards, Q. C.—Witness said he was lighting Holborn Viaduct with from 1,000 to 300 lights. The control of the lamps was in the hands of the consumers. They might turn them out or on when they pleased; therefore, he said, the supply varied from 1,000 to 300 lamps. He thought electricity should be allowed as long to establish itself as gas, that, in fact, it should not be restricted.

By Mr. Fowler.—He thought it was desirable that some authority should exercise control over the tension or pressure in electric supplies, so as to guard against danger from fire and danger to life."

No. 12.
JULY 27, 1882.

TWELFTH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the Vice President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

New York, July 27th, 1882.

PROGRESS IN THE FIRST DISTRICT, NEW YORK CITY.

The street-mains are now all laid and the entire network of underground conductors finished, aggregating over 80,000 feet, including mains on the block fronts, street intersections, bridge intersections and feeders. House connections between the street-mains and the wires in the houses are being rapidly made, meters are to be put in, and many of the larger consumers of light are either adapting their gas fixtures to the electric light, or are putting in new fixtures especially designed for our lamps. The Board of Underwriters allow us to at once introduce our conductors into buildings under the limitations set forth in the following circular:

"New York Board of Fire Underwriters,
COMMITTEE ON POLICE AND ORIGIN OF FIRES,
Boreel Building.

No. 115 Broadway,
New York, July 6, 1882.

The Edison Electric Illuminating Co. of New York:

Gentlemen—In accordance with your request for a letter which you can show to your customers, we beg to say, that the introduction of the Edison conductors from the street mains into the buildings will not of itself affect the insurance on such buildings, provided that the exposed ends of the wires or rods are covered with insulated tape and separated from each other by pasteboard, and a metal cap is screwed on the extreme end of pipe, and also provided that no connection is made between the service pipe and the house wiring.

Before such connection is made, however, and the Edison light is used in any building, the wiring and arrangements in such building must be examined by the authorized inspector of this Board, and a certificate of conformity given.

Respectfully yours,
WM. A. ANDERSON,
Chairman of Committee."

The equipment of the central station building in Pearl street is also finished. Fire was built under the boilers for the first time on June 29th, and on the next day the small engine used for the coal conveyers, blowers, &c., was started and all that portion of the equipment was found to work well. The first steam dynamo was started July 5th; and, July 8th, a satisfactory experiment was made on 1,000 lamps arranged on an upper floor. Since that date, some of the other engines and dynamos have been carefully tested with the 1,000 lamps, and the details of their adjustment perfected. The field regulating apparatus has also been tested, and the electrical indicator, the first ever used on so large a scale, has also been found satisfactory. This regulator is used in connection with regulating the electric pressure

throughout the entire district so as to keep the candle-power of the lamps uniform irrespective of changes in the number of lamps burning.

One of the most important tests, namely, the strength of the iron structure upon which rest the six steam dynamos weighing 180 tons, has just been finished. At the request of Mr. Clarke, two outside engineers, experts in iron structures, were called in to make the tests, and to pass upon the reports touching the strength of the structure, heretofore made by our own engineers. These two experts, Mr. C. C. Schneider and Mr. A. Schweizer, have made a favorable report, stating that the "structure is sufficiently strong to carry the loads imposed upon it, which produce a strain of 12,000 lbs. per square inch in the extreme fibre of the floor beams, which is the customary strain allowed for wrought iron constructions in buildings."

The entire plant in the First District, including the network of conductors and the equipment at the Central Station, having now been tested from a mechanical stand-point, the next thing to be done is to test the plant electrically. This will be done by Mr. Edison personally. Many tests and experiments both of a scientific nature and as furnishing data of commercial value to us in connection with future Central Stations, will now be made. Light will not be furnished to customers, or, in popular language, the "district will not be lighted up," until these experiments shall have been finished. Probably they will take about a month.

BORDEAUX EXPOSITION, FRANCE. The Edison light will be used in the theatre of the Bordeaux Exposition, also in the orchestra, the garden and the aquarium, requiring an installation of about 200 lamps.

ADIRONDACKS, NEW YORK. HOTEL LIGHTED. The Prospect House, Blue Mountain Lake, Adirondacks, N. Y., is now lighted with a plant consisting of two Z dynamos, 275 A lamps, and 75 B lamps. It is not intended that all of these lamps shall be run at once, the equivalent of 125 A lamps being the maximum to be run by the two dynamos. The boiler is fired exclusively with wood, which is worth twenty-five cents a cord, and the first night the lamps were lighted, 125 lights were run six hours with only one quarter of a cord of wood, at a cost of 6¼ cents for fuel.

ROME, ITALY. A small Edison plant has just been installed under the direction of Monsieur Mengarini, Professor Technical School.

WINSTED. SILK MILL TO BE LIGHTED. We have received an order from the New England Pin Company, Winsted, for one K dynamo, and 350 ten candle power lamps to light their silk mill. The plant is to be installed before September 1st.

FINLAND. The plant at Tammerford consisting of 240 B lamps has now been running more than four months, and is so well liked that orders have been given for the plant to be increased to 1,000 lamps.

THE PARIS EXPOSITION. REPORT ON LAMPS. The report of the Sub-commission on Incandescent Lamps, International Exhibition of Electricity, Paris, 1881, has at last been published. It is a lengthy document containing an exhaustive description of the four incandescent lamps exhibited, also a critical analysis with experimental results of the efficiency of each lamp. The lamps reported on are those of Edison, Swan, Maxim and Lane-

Fox; and the superiority of the Edison lamp in every respect is established, and especially in respect to (1) high resistance, (2) loss of current per minute, (3) comparative energy required, (4) number of lamps per horse power, and (5) general efficiency.

First. Regarding the important economic feature of high resistance, the report sets forth as one of the "conclusions" of the commission, that there is "greater economy in high resistance lamps than in low resistance." Accordingly the resistance of the four different lamps reported upon was carefully measured. The result appears in the following extract from the report:

"The resistance of the lamps cold was measured on a Wheatstone's bridge of the ordinary form and in the usual way. The Edison lamps were taken at random from the stock on hand. The Swan lamps were furnished by Mr. Edmunds, the Lane-Fox lamps by Mr. Stewart, and the Maxim lamps by Mr. Lockwood. Twenty-four of each were taken (except the Lane-Fox, of which only fifteen were furnished), and ten were selected from these for the tests. The following are the results obtained:

Number	Edison.	Swan.	Lane-Fox	Maxim.
1	237	74	53	73
2	233	50	56	54
3	268	54	56	76
4	260	73	56	74
5	251	55	54	74
6	228	72	50	71
7	227	39	53	68
8	249	67	52	63
9	219	55	57	65
10	237	52	63	73
Mean	241	59	55	72 "

Second. The loss of current per minute in the case of each lamp was tested, with the following results, set forth in the report: Edison lamp, 0.2483; Swan lamp, 0.2695; Lane-Fox lamp, 0.2647; Maxim lamp, 0.2586.

Third. The efficiency and economy of the Edison lamp are further shown by comparing the electric energy required to

illumine the different lamps. The report shows that when the lamps are burning at 16 candles, the kilogram-meters of energy required for the various lamps is as follows: Edison, 5.911; Swan, 7.059; Lane-Fox, 7.089; and Maxim, 7.939. At 32 candles the following kilogram-meters were required: Edison, 7.604; Swan, 9.67; Lane-Fox, 8.936; and Maxim, 10.03.

Fourth. The number of lamps and candles per horse power were exhaustively tested, full details of the tests being given in the report. The Edison lamp was found to be the best, as appears by the following extract from the report:

"SUMMARY OF RESULTS.

(a). *At Sixteen Candles.*

	Edison	Swan	Lane-Fox.	Maxim
Lamps per horse-power - -	12.73	10.71	10.61	9.48
Candles per horse-power - -	196.4	177.92	173.58	151.27
Lamps of sixteen candles per horse-power - -	12.28	11.12	10.85	9.45

(b). *At Thirty-two Candles.*

	Edison	Swan	Lane-Fox.	Maxim
Lamps per horse-power - -	9.88	7.90	8.47	7.50
Candles per horse-power - -	307.25	262.49	276.89	239.41
Lamps of 32 candles per horse-power	9.60	8.20	8.65	7.48 "

Fifth. The relative efficiency of the four lamps is set forth by a series of analytical tables, which are summed up in the report as follows:

"The relative efficiency of the four lamps examined, expressed in Carcel burners of 7.4 spermaceti candles each, produced by one horse power of current, is as follows: (A) At 16 candles: Edison, 26.5; Swan, 24.0; Lane-Fox, 23.5; and Maxim, 20.4; (B) at 32 candles: Edison, 41.5; Lane-Fox, 37.4; Swan, 35.5; and Maxim, 32.4."

The full text of the report was published in the London *Electrician*, June 17th, 1882, and copies of a reprint can be had from the Edison Company, No. 65 Fifth Avenue, New York City.

PAWTUCKET, R. I. ANOTHER COTTON MILL PLANT. We have received an order from the Slater Manufacturing Company, Pawtucket, R. I., for two L dynamos with 325 A lamps.

WATERVILLE, MAINE. ANOTHER FACTORY LIGHTED. A plant of one K dynamo with 250 A lamps has just been ordered for the Lockwood Company's Mill No. 2, at Waterville.

DANGER FROM GAS. An explosion of gas recently occurred at Havana, in the evening, which left part of the city in darkness. It seems that the water main rested on the gas main and both pipes becoming broken on account of settling, the gas entered the houses through the sewers, and there exploded with great force, tearing up floors, demolishing furniture, singeing hair and causing several deaths. Several houses were simultaneously injured in this way. * * * Lillie Vent and Emile Corsie were found in state room 147 of the Fall River Steamer, Providence, on May 5th, unconscious and nearly suffocated by gas with which the stateroom was filled. It was taken for granted that they blew out the gas on retiring, but the opinion of Mr. C. B. Dix, published in the New York *Sun* of May 8th last, brings up a different theory on the subject. He says:

"I travel on the Fall River boats frequently. The gas oftens sputters and flickers as if there were air mixed with it or the pressure were not uniform. Last Tuesday night I came down from Fall River in the Providence, and occupied room 145, which is close to 147. Before I went to sleep I noticed that the gas jet was flickering and sputtering as usual. I paid little attention to it and dropped off to sleep. About midnight I awoke suddenly. My room was full of gas. The flame, which I had left burning at almost full head, had gone out. I sprang out of bed, threw open door and window, and turned off the gas. If I hadn't happened to wake up just at that time I might have been found suffocated in the morning. People would have said that I blew out the gas, and if I had been seen to take a nightcap before I went to bed, it all would have been laid to rum."

* * * Fire Marshal Sheldon in his report on the fires in this city in 1881, states that 32 fires in that year were directly caused by gas, 28 of

which were by the igniting of escaping gas, 3 by explosions of gas, and 1 by explosion of a gas meter. He also calls attention to fires from window curtains, goods in stores or show windows, Christmas trees, clothing, drapery and woodwork, ignited by gas jets, lamps and candles, of which fires there were 99 in the year 1881. * * * James W. Langley, of Newport, R. I., was suffocated with gas, on board a Newport boat, at Fall River Mass. * * * On the 7th of June, Eliot Lavinus, aged nineteen, of Trenton, N. J., was discovered insensible, at No. 176 Washington Street, in this city, having inhaled illuminating gas. * * * Jacob Oesterhoudt, of Rosendale, was found suffocated in his bed, at the Mansion House, June 4th, having blown out the gas upon retiring. * * * A terrific explosion of gas occurred in the Stanton air shaft, Wilkesbarre, Pa., June 15th. One man was instantly killed, and four men were known to be horribly mutilated, with little chance of recovery.

NEW YORK CITY. DRY GOODS STORE TO BE LIGHTED. Messrs. Aitken, Son & Co., corner Broadway and Eighteenth street, New York City, have ordered a Z dynamo, with 36 A lamps and 36 B lamps, to light their store.

THE EUROPEAN COMPANY START A BULLETIN. We have received from Paris the first number of a Bulletin, dated June 24, started there by the Compagnie Continentale Edison. We give it a hearty welcome. It is a small pamphlet modeled after this Bulletin, although printed with smaller pages and larger type and containing less words to the page, our pages containing 398 words, while the French Bulletin page contains only 291 words. Any stockholder in the European Company (The Edison Electric Light Company of Europe, Limited), desiring to have the French Bulletin mailed to him, can doubtless be accommodated,

if he will send his address to the Compagnie Continentale Edison, 27 Chaussée d'Antin, Paris, France.

THE CHICAGO COMPANY. The following is a list of the stockholders in the Western Edison Light Company, just organized in Chicago. The Company has taken a building and commenced business at Nos. 51 and 53 Wabash Ave. The stockholders are as follows:

Adams, George E.
Allerton, Samuel W.
Barrett, J. P.
Bishop, H. W.
Bliss, George H.
Bullwinkle, B. B.
Caton, J. D.
Clarke, George C.
Clark, John M.
Clowry, R. C.
Cowles, Alfred
Crerar, John
Cummings, C. R.
Doane, J. W.
Drake, John B.
Elliott, Henry
Fargo, Charles
Farwell, C. B.
Farwell, John V.
Field, Marshall
Foltz, Fritz
Howard, W. B.
Johnston, P. D.
Jones, Hiram J.
Keith, Edson
Louderback, D. H.
Merrill, Samuel
Moody, John A.
Perkins, C. E.
Pullman, George M.
Rand, William H.
Roper, John
Seeberger, Anthony F.
Seeberger, C. D.
Sheridan, P. H.
Simmons, Z. G.
Sprague, O. S. A.
Smith, William H.
Stager, Anson
Sturges, George
Thompson, John L.
Treat, Samuel A.
Wadskier, T. V.
Williams, Edward H.
Williams, Norman

The officers of the Chicago Company are Anson Stager, President; John M. Clark, Vice-President and Treasurer; D. H. Louderback, Secretary; Geo. H. Bliss, General Superintendent; and P. D. Johnston, Engineer.

THE LIFE OF OUR LAMPS AT HOLYOKE. Mr. Bancroft makes the following report, July 20th, about the life of our lamps

in Mill No. 3 of the Merrick Thread Co., Holyoke, Mass. He says:

"The 95 lamps in the Merrick No. 3 mill were put in operation April 5th, and on the morning of to-day, July 20th, had completed a run of 722 hours, with a loss of only five lamps burned out. The longest run was 13 hours, April 19th; and the shortest runs were 8½ hours on four different days in June. The dynamo works well and requires but slight attention."

MR. BENNETT'S YACHT NAMOUNA AGAIN. A written report received from the yacht Namouna, which is lighted with an Edison plant as published in the Ninth Bulletin, states that on the voyage across the Atlantic the lights burned without any accident and gave satisfaction to all on board.

THE WORUMBO PLANT TO BE DOUBLED. A plant of one Z dynamo with B lights was installed in one of the mills of the Worumbo Company, Lisbon Falls, Maine, as mentioned in the Tenth Bulletin. The plant has given such satisfaction that we have just been ordered to double it. The lamps are used in the weaving room, where 8-candle lamps are required for light goods and 16-candle lamps for dark work, particularly navy blues and blacks. Even with the darkest goods, measuring 82 inches in the loom, a weaver by means of two 16-candle lamps over his loom, can keep run of his bobbin in the shuttle boxes. He can also draw in his yarn, by swinging the arm of the bracket around over the warped beam, between the harness and the frame. But more important than all this, the weavers can tell colors. One of the most difficult tests is to distinguish "water blue yarn" from black, a difficult thing to do even by day light, yet the weavers succeed quite well in distinguishing those colors when using our lamps. The shuttle boxes at each of the looms are made up of four or more smaller boxes, placed one above the other, and it is

into these smaller boxes, measuring fifteen inches in length and ten inches apart, that the rays of light must be cast. The officers of the Worumbo Company speak highly of the quickness and thoroughness with which the installation of our plant was made, the plant having been installed by two men in ten days.

PHILADELPHIA. ANOTHER NEWSPAPER TO BE LIGHTED. The plant in the Public Ledger building has proved so satisfactory that another Philadelphia newspaper, the *Public Record*, has decided to introduce our light, and has given us an order. The plant will consist of one K dynamo, 250 A lamps, to light the new Record building now being built on Chestnut Street.

EDISON LIGHT FIXTURES FOR HOUSES. Messrs. Bergmann & Company have just issued a new and enlarged edition of their catalogue of electric light fixtures for houses, including electroliers, pendants, hall lights, newels, a great variety of brackets including stationary, desk and swinging brackets, hand lamps, portable lamps and a large variety of other appliances. There are also designs of combination light brackets for both electric light and gas, a feature to which the firm have given a good deal of attention. We notice that they have dropped the use of the word chandelier, and in its place have adopted the word electrolier, which is already in general use in England to indicate an electric light chandelier. Copies of the catalogue of Messrs. Bergmann & Company can be obtained at their factory, No. 108 Wooster St., New York City.

NEW YORK CITY. AN INCREASED PLANT. The small plant of 15 lights, belonging to Max Ams, 372 Greenwich Street, and mentioned in the Tenth Bulletin, gave such satisfaction that Mr.

Ams ordered his plant increased to 62 lamps, and the increased plant has been started with success.

CAPE TOWN. PARLIAMENT LIGHTED. The House of Assembly at Cape Town, Cape of Good Hope, is now lighted with a Z dynamo and about 60 lights. The Cape *Times*, of May 11th, says:

"The House of Assembly was publicly lighted for the first time last evening by the electric lighting apparatus which has been fitted up by a representative of Mr. Edison, the celebrated American inventor. The light was tried on the previous evening and the result proved quite satisfactory. At five o'clock yesterday afternoon the light was turned on without any previous warning, and before the honorable members recovered from the surprise occasioned by the novel sight, the House was illuminated by the beautifully bright and steady glow of the forty-four lights placed along the walls. There are thirty-four of these lights in the body of the House, and ten in the public gallery. The present experiment has been undertaken by Mr. Edison, at the instance of the Colonial Goverment, with the view of enabling them to decide whether it is expedient to introduce the electric light into the New Houses of Parliament. The apparatus has been fitted up under the direction of Mr. C. Hortsek, who was specially sent out by Mr. Edison for the purpose. The engine and apparatus are placed in a large shed at the top of the gardens, and are connected with the House by means of an insulated wire. The engine used is a ten-horse power one, and the generator is known as the Edison Z dynamo-machine, calculated to produce current sufficient for 60 sixteen-candle lights. There was a large attendance of the public in the House last evening, and much satisfaction was expressed alike by members and spectators with the effect produced by the bright, soft, and penetrating light."

HOLYOKE, MASS. WOOLLEN MILL LIGHTED. The Germania Mills, Holyoke, Mass., have ordered a plant consisting of one Z dynamo and 60 A lamps, to be installed at once.

BRUNN, AUSTRIA. Contracts have been concluded to light the new theatre, to be finished in October, with the Edison light. The installation will consist of 800 A lights, and will be run every night, including Sundays, for ten months in the year. The dynamos will be placed 800 feet from the theatre on a piece of ground furnished by the City. The theatre will have no gas and the chandeliers

and fixtures will be made for the Edison light alone and cannot be used for gas.

THE SWAN LAMP PATENTS. The following report on the Swan Lamp Patents, originally prepared for the instruction of our agents, is now printed for the benefit of our stockholders.

Mr. Joseph Wilson Swan, of England, after whom the "Swan Lamp" is named, has only two patents in the United States, relating to incandescent electric lamps. The first, No. 233,445, was applied for April 12th, 1880, and granted October 19th, 1880; the second, No. 234,345, was applied for June 16th, 1880, and granted November 9th, 1880. These are the only patents on the "Swan Lamp" in the United States.

Before stating what these patents cover, let us see what they do not cover. In that regard, Mr. Swan's own admissions are important. In his specification filed when he applied for his first patent (No. 233,445), he says: "My invention relates to that kind of electric lamp in which light is produced by the incandescence of a continuous conductor of carbon enclosed in an exhausted glass bulb, and provides means for increasing the durability of the said kind of lamp." Just what is meant by this statement prepared by Mr. Swan himself should be carefully noted. What does he mean?

First. Swan does not claim himself to have invented an "electric lamp", but merely to have invented "means for increasing the durability" of one. In other words he claims only an improvement on an existing lamp.

Second. The "kind of lamp" which his invention "relates to", was one which he found in existence when he undertook to improve it; one, he says, "in which light is produced by the incandescence of a continuous conductor of carbon enclosed in an exhausted glass

bulb". That is to say, Mr. Swan found such a lamp in existence, and he tried to improve it.

Third. This description of an electric lamp which Mr. Swan undertook to improve, is an exact description of the Edison incandescent lamp, on which a patent was allowed to Mr. Edison in the United States, December 19th, 1879, and issued to him (No. 223,898) January 27th, 1880, several months before Mr. Swan even filed his application for his first patent. This patent thus granted to Edison was for "an electric lamp for giving light by incandescence", by means of "carbon filaments" inclosed in a "receiver made entirely of glass from which the air is exhausted", which is exactly the lamp referred to and described by Mr. Swan, at a later date, in his patent.

Thus it appears that Mr. Swan himself disclaims to have invented an incandescent electric lamp, and that all he claims to cover by his patents (this is true of his second patent as well as his first) are merely minor points of mechanical detail, being merely alleged improvements in the durability of an incandescent lamp already in existence.

Let us now see just what these alleged inventions claimed by Mr. Swan amount to. His first patent (No. 233,445) has four claims, viz: first, platinum caps connected to both the glass and the leading-in wires, second, the carbon loop or horsehoe formed from a straight strip of parchment paper bent into shape, third, the carbon made of parchment paper, and, fourth, coating the leading-in wires and caps with glass or enamel. His second patent (No. 234,345), contains two claims: first, parchmentizing thread prior to its carbonization, and, second, making enlarged ends therein by wrapping material thereatound and cementing the wrapped material by parchmentization.

Are these alleged inventions, admitting that they are such, of any value? Let us consider them in order.

In Swan's first patent the first claim is for platinum caps uniting

the glass and leading-in wires. Mr. Edison uses the platinum leading-in wires, but omits the cap. Mr. Swan claims that the use of the platinum cap is an improvement on Mr. Edison's method, because a better contact may be made between the platinum and the glass. The fact is, Edison early tried both ways and the result of his experiments was that the contact was just as good in one case as in the other, and that the omission of the platinum cap, which alone costs nearly as much as Edison's entire lamp as now manufactured was an important step towards economy. Besides that, if the small platinum leading-in wires will not make a reliable union with the glass, surely Swan's increase of the platinum surface will not remedy the defect. If there be any defect in such union in the one case, it will still exist even to a greater extent in the other.

The second claim in Mr. Swan's first patent is for a straight strip of paper bent into a loop or horseshoe. This was the form first used by Edison, and probably by every other experimenter on lamps. But Edison improved upon it. His improvement consists of cutting the paper into shape, instead of bending it, it being evident to any one that by cutting paper into exact shape, greater uniformity of result can be attained than by bending, and no special care or work is needed in ensuring that all loops shall be uniform.

The third point in Swan's first patent, and the first point of his second patent, is parchmentization prior to carbonization. Edison tested this as early as 1878, and he soon after mentioned it in a caveat, but he found no gain in this additional step of parchmentization. Besides, it cost money and increased the cost of production of the finished lamp.

The fourth claim in Swan's first patent is coating the leading-in wires and caps with glass or enamel. This is to avoid the difficulty arising from "occluded gases." Mr. Edison long ago dispensed with the use of this coating, and states that is is an unnecessary trou-

ble and expense. He makes his lamps without it, and yet finds no difficulty from "occluded gases." The use of the coating, claimed by Mr. Swan to be an improvement, unnecessarily increases the cost of the lamp, and shows that somewhere in the lamp something has not been properly provided for and done, or, in other words, that there has been poor workmanship.

The only remaining point in the Swan patents, is making the enlarged ends by wrapping. This is neither so cheap, effective or simple as the later plan invented by and now used by Mr. Edison, namely, simply striking out or cutting the carbon with its enlarged ends homogeneous with the body. By the latter, there are no additional steps, while by the Swan plan, there is an additional step, requiring tedious and delicate manipulation, adding to the cost.

It thus appears that Mr. Swan's so-called improvements on parts of the incandescent lamp are, commercially speaking, of little value. Every point claimed by Swan, is something discarded by Edison in his march towards simplification, which means the best result, and the best service for the least money.

Having thus shown what the alleged inventions in the two Swan patents amount to, let us see whether Mr. Swan has a good title even to what he claims.

Upon the second and third points in his first patent Swan is already in interference in the Patent Office with both Edison and Maxim. On such points, Swan being a foreigner, the earliest date of invention which under the law he will be permitted to prove, is either the date of filing his application in this country, viz: April 12th, 1880, or the date of his earliest foreign publication, namely, his English patent of July 20th, 1880. Both Edison and Maxim, in their preliminary statements, set up dates long anterior to Swan's earliest legal dates in this country, and there can be no doubt that one or the other will prevail

against him and receive the valid patent on these points. As to his second patent, applied for June 16th, 1880, which is the earliest date of invention our law assigns to him, being a foreign inventor, as against a citizen inventor, Mr. Edison attacks him on the broad grounds of making enlarged ends by wrapping around the end of the carbons. This invention was not only made, but was publicly mentioned by Mr. Edison long before Mr. Swan's earliest date of June 16th, 1880. Indeed, it was even described in one of Mr. Edison's patents (Edison's Canadian patent No. 11,520) filed before that date. There can be no doubt, therefore, that Edison will prevail against Swan on this point. Thus of the few things claimed by Swan in his two patents, it is certain he cannot hold two of them, and it is probable, for reasons which should not now be divulged, that he can not hold any. But even if he could hold them all, Mr. Edison would be entirely unaffected, because Mr. Swan's patents are simply for matters of detail, and Mr. Edison has long since abandoned them for better methods. Swan covers nothing Edison uses, and what Swan uses Edison has left behind.

Thus it appears, with regard to the Swan patents, first, that they do not cover an electric lamp, and contain no broad or fundamental principles, but are matters of mere mechanical detail; second, with reference to a part of the alleged inventions embraced in the patents, Swan is in interference with two other inventors, and there is every reason to believe he will be defeated; third, that the art of making an incandescent lamp has advanced so far since Swan's alleged inventions were made as to make them obsolete; and, fourth, even if they were not obsolete, they add so much to the cost of labor and material, they are practically worthless.

But it must be remembered that even if Mr. Swan's patents were for a lamp instead of for a few details of one, and even if those details were important instead of being worthless, his patents would

still amount to nothing unless he had also invented and patented a comprehensive system of using them. In this respect Mr. Swan has nothing. He has no patents whatever on any system or on any of the almost innumerable details needed in a lighting system, involving regulation, distribution, measurement, conductors, safety-catches, meters, chandeliers, brackets, drop lights, etc.; nor do the Swan patents confer any right on him to use any such things, or even to make a lamp. The slightest use of what he alleges to be his inventions involves infringement of underlying patents granted to another. All these details of the necessary parts of a system of incandescent lighting have been elaborated and patented by Mr. Edison. It is impossible to make or introduce an incandescent lamp without them.

In this connection, a concise statement should be made of Mr. Edison's patents, including his fundamental patents on an electric lamp, his patents on methods of manufacturing a lamp and mechanical details, together with his large number of patents on the important details of a system of incandescent lighting. The fundamental patents, which give Edison a monopoly of the incandescent lamp, are as follows, namely, No. 223,898, dated January 27th, 1880; No. 227,229, dated May 4th, 1880; and No. 230,255, dated July 20th, 1880. Besides these, Mr. Edison has 34 other patents already granted in this country on the lamp alone, and has applications for 56 more patents on the lamp alone now awaiting decision. In these patents, and especially in the first three above named, the following points are broadly covered to Mr. Edison:

1. An electric lamp having a continuous conductor (without regard to its material, resistance or mode of preparation) and an exhausted glass enclosing globe.

2. An electric Lamp having a continuous carbon conductor (irrespective of its material, resistance or mode of preparation) and an exhausted glass enclosing globe.

3. A filament of carbon of high resistance secured to metallic conductors (i. e., the leading-in wires).

4. The method of manufacture, i. e., first, separately forming the enclosing globe and the support for the carbon, and then affixing the carbon upon the latter, uniting the globe and support and then exhausting.

The broad principles covered in the above named fundamental patents allowed to Mr. Edison are so exclusive that it is not too much to say that neither Swan nor any one else has made or can make a successful incandescent lamp without infringing every one of the above patents.

But these patents allowed to Mr. Edison on his lamp, are only a small portion of the patents allowed to him in connection with the use of the lamp. Up to the present time no less than 129 patents have been allowed Mr. Edison, in the United States alone, on his lamp and on the details connected with its manufacture and use, and he also has 104 additional applications for patents on the same subject now awaiting examination at the Patent Office. These patents cover such subjects as the lamp, regulators, dynamos, meters, motors, conductors, underground mains, junction boxes, sockets, chandeliers, brackets, and many other devices, altogether constituting a complete and perfect *system* of electric lighting.

The whole subject of the Swan patents in the United States may be summed up as follows:

1st. Mr. Edison is an original inventor of a new type or genus of lamp. Mr. Swan does not claim to be such an inventor, and claims only to have made improvements of detail in such a class or genus. Indeed Swan disclaims the inventorship of the class or genus.

2nd. This new type or genus of lamp is patented broadly to Mr. Edison.

3rd. All that Mr. Swan claims are only some minor features of

alleged improvements, but it is doubtful if they really are improvements, *all* of them having been tried and discarded by Edison, for simpler and more economical means equally or more efficient for the ends sought, long before Mr. Swan's patents were issued.

4th. Mr. Swan's title to some of the points or improvements he even does claim, is in litigation. If he prevails in the litigation, he cannot injure Mr. Edison, as Mr. Edison uses none of the points in controversy. Nor could Swan even then make and use a lamp, for he must infringe, in using his own alleged inventions, several prior fundamental patents previously issued to Edison.

The Swan Lamp has not yet been manufactured or sold in this country. Until that is done, or some other overt act is committed constituting an infringement, no legal proceedings against the Swan Lamp can be begun.

No. 13.

AUGUST 28, 1882.

THIRTEENTH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the Vice President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

NEW YORK, August 28th, 1882.

PROGRESS IN THE FIRST DISTRICT, NEW YORK CITY.

Everything is now completed. The tests and experiments referred to in the last Bulletin are being rapidly made. No serious obstacles have as yet been developed to delay the early lighting up of the entire district on a large scale. A number of buildings in various parts of the district have already been lighted. The wires in all the wired houses in the district, 946 places altogether, are being connected with the street mains as rapidly as possible, 225 houses having been connected at the time of the last formal report, August 26th, and additional houses being now connected and inspected daily. Meters to measure the current sold to each consumer, also electroliers and brackets to hold the lamps in the rooms, are being rapidly put in. Up to August 26th, 82 buildings, having 1,152 lamps, had been equipped with these fixtures, and the work is now progressing at the rate of about 20 buildings a day.

MANCHESTER, ENGLAND. AN EXHIBITION LIGHTED. At the annual meeting of the Society of Chemical Industry, Manchester, July, 1882, an exhibition in the chemical laboratory, of the present development of the dye and calico print industries, was lighted by an Edison plant of 70 lamps.

LORRAINE WOOLEN MILL TO BE LIGHTED. Messrs. W. F. & F. C. Sayles, Saylesville, R. I., have ordered a plant consisting of one K and one L dynamo, with 400 sixteen candle lights, for the Lorraine Manufacturing Company, manufacturers of fine woolen goods.

AMSTERDAM, HOLLAND. A CENTRAL STATION. The Edison Company in Holland have purchased ground for a central station at Amsterdam, and have ordered two steam dynamos like those used in the New York City Pearl street station, to be delivered in October. The central station would have been commenced at an earlier date, but there has been some difficulty in obtaining the right of way under the streets.

PARIS, FRANCE. EDISON LIGHT IN THE PREFECTURE OF THE SEINE. A plant of 60 Edison lamps has been in operation in the Prefecture of the Seine for three months past, and has given entire satisfaction. This plant was taken into France from abroad, by special permission of the French Minister of Commerce.

HUDSON, N. Y. A MILL LIGHTED. The Harder Knitting Company, Hudson, have ordered a plant of one L dynamo and 150 A lamps for use in their new mill. The building is said to be fitted with every known improvement in machinery, including a 150 H. P.

Corliss engine, and two tubular Babcock & Wilcox boilers. After carefully investigating the best known systems of artificial illumination, including gas machines and arc lights, the Harder Company decided to adopt the Edison light.

EDISON'S SUIT AGAINST THE MAXIM LAMP FOR INFRINGEMENT. PARIS. The suit brought at Paris, France, by the Edison Company against Hiram S. Maxim, for infringing Edison's incandescent electric light patents, has been noted for trial, and we are instructed that the trial will take place in November. The management of the suit in behalf of the Edison patents is conducted by MM. Pouillet and Oscar Falerteuf, avocats; M. Goirin, avoué; and M. Armengaud, patent counsel and expert. Additional experts, prominent in scientific circles, have also been retained.

EDISON'S SUIT AGAINST THE SWAN LAMP FOR INFRINGEMENT, LONDON. A patent suit has been commenced in London by the Edison Company against the Swan Company, on the ground that the Swan lamp infringes the Edison. The fundamental principles of incandescent lamps are at issue in the suit. The preliminary hearing took place before Mr. Justice Chitty, London, July 28th, and the Swan Company was ordered by the Court to keep an account of their manufacture of lamps pending the trial.

HOLYOKE. A MILL PLANT ENLARGED. A plant consisting of a Z dynamo, 120 B lamps, was started last April in the mill of the Merrick Thread Company, Holyoke, Mass. Since that time the company has made a thorough test of the system as adapted to their work of manufacturing thread, and have now decided to increase the plant from 120 to 360 lamps. The increased plant will consist of one K dynamo to be installed at once.

BERLIN, GERMANY. BREWERY LIGHTED. A plant of 12. B lamps has just been installed in the Boehmisches Brauhaus, lighting the cellars and malt house of the brewery. The following interesting description of this installation has been received from Mr. Seubel:

"There are three large malt cellars where in order that the temperature may be kept low, no gas is used, and even the sunlight is excluded. Heretofore the lighting has been done by candles. Very little light is needed for malting purposes, so there are but 15 B lamps in a space of about 1500 square meters of floor. The lamps, which can be turned on or off by one switch, are suspended downward without shades, the low whitewashed ceiling acting as a reflector. The lights in the malt house are run day and night. In the fermenting and storage cellars, where the temperature must be kept nearly at zero, the walls are wet, and the carbonic acid, discharged from the fermenting beer acts on the ordinary insulation of wires and on the iron parts of the sockets, also on the plaster portion of the lamps. This made the wiring and lighting of these cellars difficult. But all trouble has been overcome and the installation has been made in such a way as to be permanent. In the fermenting cellars portable lamps were required, to replace candles, and a good light was required for 'tub washing.' To make our lamps suitable for these requirements, we placed our ordinary cut-out cleats in small cast iron boxes, provided with a door with rubber packing, all over the cellar. Six of these lanterns with a B lamp in each were made for each cellar, and a stout rubber tube 5 or 6 meters long with good flexible double conductor inside was attached to each lamp, the other end of the flexible conductors being connected to the cut-out cleat and provided with a sort of cut-out plug, by means of which the conducting cord is attached to the connection box. The socket is surrounded with a tin collar so that the lamp can be reversed and set on the floor for washing the inside of the tubes, while stout iron wires outside act as a guard against breakage. Whenever a workman needs light in any part of the cellar he attaches a lamp with conducting cord at the most convenient connection box. This portable lamp has met the approval of the cellar master and the director of the brewery. In the storage cellars, similar connection boxes are used, sunk into the brick work so as to be out of the way in moving large barrels. In one part of the storage cellars, the barrels are stored in seven tiers and built up three high to the ceiling. Light is there required for laying in and filling empty barrels, for which purpose 4 B lamps are fastened on the ceiling with a good reflector. Light is also required for drawing off the beer into small casks, and for that purpose the portable lights above described are used, except that an iron screw clamp is attached to the lantern, capable of being screwed against the head of the barrel. The brick work is occasionally washed off with

dilute sulphuric acid, consequently the conductors have been covered with lead and sunk in the wall."

THE THURBER PLANT TO BE DOUBLED AGAIN. The first plant installed in the wholesale grocery store of Messrs. H. K. & F. B. Thurber & Co., New York City, was a single Z dynamo. After trial, the plant was doubled to two Z dynamos, as reported in the Eighth Bulletin. We have just received an order to double the plant a second time, and a K dynamo, 250 lamps, will at once be installed. Hereafter they will use the Edison light throughout, to the exclusion of gas.

CHICAGO. CLUB, THEATRE, STORES AND RESIDENCES TO BE LIGHTED. Five plants are now being installed in Chicago, as follows:

(1). The Calumet Club is to be lighted with a Z dynamo, 60 sixteen candle lamps, as soon as the plant can be installed.

(2). A plant of one L dynamo, 125 sixteen candle lamps, has been ordered for the Academy of Music.

(3). The residence of Mr. N. K. Fairbanks is being equipped with a Z dynamo and 60 sixteen candle lamps.

(4). A plant of one K dynamo, 250 sixteen candle lamps, is to be installed to light the residences of Messrs. J. W. Doane, Marshall Field, Edson Keith, and O. R. Keith. The engine and dynamo belonging to this plant will be located in Mr. Doane's stable.

(5). A plant of one K dynamo, 250 sixteen candle lamps, is being placed in the building of the Western Edison Light Company, Nos. 51 and 53 Wabash Avenue. The lights will be used in the offices of the company, also to supply light to several wholesale stores near by.

LAWRENCE. PEMBERTON MILL PLANT INCREASED. Last November a plant consisting of one Z dynamo, 125 B lamps,

was started in the weaving room of the Pemberton Company, Lawrence, Mass. The plant has given such satisfaction that the Pemberton Company has ordered it to be increased by the addition of two L dynamos and 250 A lamps. In this connection the following letter from Mr. Clarke, the agent of the Pemberton Company, and never before published in the Bulletin, will be of interest:

"PEMBERTON COMPANY,
Agent's Office,
LAWRENCE, MASS., March 6th, 1882.

THE EDISON COMPANY FOR ISOLATED LIGHTING:

DEAR SIRS:—We have now been using the Edison light in our weaving room for over three months, and are glad to state that it has given, and is now giving us good satisfaction. We are lighting two looms making fancy colored goods with one 'A' lamp, and our weavers are enabled to distinguish the different shades of colors readily. The steadiness of the light, its safety, its being practically free from heat, the slight care required in the operation of the dynamo, all combine to make your light a desirable one for manufacturers.

Yours truly,
F. E. CLARKE,
Agent."

LINCOLN, ENGLAND. THE LIGHT ENDORSED. Messrs. Robey & Company, Lincoln, England, have written a letter, July 11th, to The Edison Electric Light Company, Limited, London, strongly endorsing the Edison plant in use in their shops. The following extracts from the letter are of interest:

"The experimental trial we made of the Edison system of electric light in our work-shops has succeeded admirably. We used in all 120 lights giving one to each man. The experiment was simply and easily tried by unscrewing the gas burners and affixing the electric lamps to the old gas fittings. Though we used only half lamps, namely 8-candle power, yet we found the light given from them to be quite equal to a large gas burner, and to be much superior in its adaptability for work-shop purposes, inasmuch as the light can be turned upside-down and placed within cylinders and other parts of engines without losing anything in brightness, as is the case with a gas jet when thus used. Our men found it very comfortable to work with, the atmosphere of the shop not only being less heated, but also much purer than is possible when gas

lights are used. We were so satisfied with the result of the experiment that in some very large works which we are now building, we are putting in Edison lamps only, a few arc lights for the large space, and incandescent lamps for the bench and tool work—and entirely dispensing with gas. One very great advantage we find in the use of the Edison incandescent lamp is its absolute safety and the great convenience and saving of time it is to the workmen, who are able to turn their lights in and out as may be required without the trouble and danger incidental to the use of a match or other naked light to light them."

MUNICH, BAVARIA. A LARGE PLANT. A plant of 4 K dynamos and about 800 A lamps is being installed in Munich for the purpose of partially lighting up the Munich Exposition, opening in October. Especial attention will be paid at this Exposition to the general subject of electric lighting and the use of electricity for power. Accurate tests will be made regarding the efficiency of competing systems of electric lighting. The Managers of the Exposition invited the various electric light companies to compete for the lighting of the theatre. Several responded, including the Edison Company, but the others having one by one withdrawn, the Edison light has the field to itself. Among the other features to be exhibited in behalf of the Edison Company will be the sending of a current from a Z dynamo through conductors two miles in length, in order to furnish data to establish the economy and efficiency of the Edison dynamos at the Exposition.

SAN FRANCISCO. A STORE LIGHTED. A plant consisting of one Z dynamo and about 60 lights was started August 1st, in the store of H. S. Crocker & Company.

BALTIMORE. BAY LINE STEAMER LIGHTED. A plan consisting of one Z dynamo and 100 ten candle lamps is being installed on the steamer Carolina, of the Bay Line, running between Baltimore and Norfolk. The lights are to be distributed

throughout the dining room, upper saloons, state rooms, and engine and boiler rooms. In the upper saloons the lamps are to be attached to the present chandeliers.

BOSTON. HOTEL VENDOME. This plant, mentioned in the Eleventh Bulletin, has been running every night since the evening of June 30th, with 62 lights in circuit. The plant consists of 63 A lights, mostly used on the ground floor, 42 being in the dining room where they are arranged on 7 chandeliers with 6 lamps each, and on one large chandelier with 8 lamps. There is also one lamp on a single bracket, and a portable student's lamp in the office, one in the elevator, 2 portable student's lamps in the reading room, 2 at the bottom of the main stair-case, 3 in the saloon, and one each in the engine room, the boiler room, and the passage way. The dynamo is driven by a small high speed engine, which also furnishes power for the passenger elevator and freight elevator, the laundry, and other machinery in the basement. The daily average service of the lamps is six hours, and the total number of hours during which they have been in use, as per our report of August 15th, was 282 hours. The number of lamps destroyed during this period is eleven. Four of these, however, were broken accidentally, leaving only seven destroyed through natural causes. One thing about this plant is worthy of especial mention, namely, the Edison lamp in the elevator. For that, a cord containing two flexible wires, thoroughly insulated, is attached, like a rubber gas pipe used for the same purpose, one end to the lamp in the elevator and the other end to the fixed wires in the side of the elevator shaft, half way up. The steadiness of the light and the absence of heat are especially noted in the elevator. The testimony of all attached to the hotel is to the effect that the illumination has been a perfect success. The engineer in charge, states that the amount of energy taken from the engine for driving the

dynamo does not exceed eight horse power: that, notwithstanding the fact that the temperature in the engine room where the dynamo is located, ranges from 118 to 130 degrees, the bearings are very little heated; and that there is but a very slight wear on the brushes; and the face of the commutator is as smooth as upon the day it was first started up.

THE ADIRONDACK HOTEL PLANT. Regarding the plant in the Prospect House, Blue Mountain Lake, Adirondack Mountains, N. Y., Mr. G. W. Waters, the engineer in charge, has just made the following report:

"The Edison incandescent electric light plant installed here was started by me June 16th, 1882, and has run without any interruption every evening since. It has run all this season on an average of about five hours per night. The plant consists of two Z dynamos, 230 A lamps, and 102 B lamps run in series. Although there is a total of 332 lamps in the building we do not have occasion to run over 125 lights at any one time. The engine runs them easily with seventy pounds indicated steam pressure. The boiler burns wood, and on a careful test has consumed only one quarter of a cord during a six hour run. As to breakage of lamps, as near as I can get at the number of hours that the lamps are burned, I think it will average fifty lamps for the whole evening, showing an average life of the lamps thus far of about eight hundred hours. The lamp which I placed in the elevator car, July 12th, has been lighted every night since successfully. The plant has given complete satisfaction to Mr. Durant, and every one who sees the light is delighted with it."

BUDA PESTH, HUNGARY. RESTAURANT LIGHTED. An Edison plant of 50 A lamps and 24 B lamps is giving excellent satisfaction in the Szikszay Restaurant in the Kerepesi, Buda Pesth. It is driven by an engine placed in a building 100 metres away.

KINGSTON, R. I. PLANT FOR THE PEACEDALE MILL. A plant consisting of one K dynamo and 250 A lamps, or an equivalent of B lamps, as may be hereafter decided upon, is being installed in the cotton mill of the Peacedale Manufacturing Company,

near Kingston. Two A lamps will be placed over each loom weaving dark colors, and two B lamps where light goods are made.

HAVANA. THE LOUVRE PLANT AGAIN. The following extract is taken from a recent letter from Mr. Rich, in charge of the Edison light in Havana, regarding the exhibition of our light now being made in the Louvre:

"Our exhibition continues to move on with unabated interest both to the public and to ourselves, and nothing remains to be desired as to the workings of the entire plant. I am pleased and somewhat surprised at the perfect working of dynamo No. 190 which runs the Louvre. We have had no occasion to touch the brushes or adjust the screws since the 25th of May, and neither the brushes nor commutator show any perceptible signs of wear or emit a spark, and visitors often inquire if the machine is actually in motion."

HIGH ALTITUDES MAKE GAS DIM. The following extract is taken from the *Journal Des Débats*, Paris, July 6th:

"Gas, upon high altitudes cuts a sad figure, an argument which the partisans of the electric light are wrong not to invoke in their favor and against gas. The electric light burns with the same brilliancy in all altitudes. Gas loses its illuminating power in proportion to its elevation above the sea level. The illuminating power of gas is subject to barometrical variations. A gas burner shines less under very low pressure than under a very high pressure. At some future day the ordinary gas burner will be used as a veritable barometer. M. Bremond is about to announce by calculation the variations in the illuminating power of gas caused by the altitude at which it burns. Experiments have been made upon the Northern Railroad of Spain, between Madrid, alt. 595 meters above the sea level, and Canada, alt. 1,375 meters. M. Bremond states that we lose a litre of gas illuminating power for every 50 meters of altitude. Hereafter, in taking Paris for a point of departure for the altitudes, the following are the figures which apply approximately to a few well known cities:

Names.	Altitudes.	Barometrical Pressure.	Illuminating Power.
Paris,	0	0.754	105
Neune,	68	0.747	103
Moscow,	255	0.732	99
Madrid,	595	0.700	87
Mexico,	2,212	0.572	30

We see here three times more light at Paris than at Mexico for the same quantity of gas. It is evident then that the illuminating efficiency of gas is three times greater in Paris than in Mexico."

SANTIAGO, CHILI. PLANT IN THE UNIVERSITY. An E dynamo, 15 A lights is running in the University of Chili. On the evening of July 12th, Professor Luiz Zegurs, Department of Physics, in a lecture on electric lighting, exhibited the Edison plant, and after various experiments with arc lamps, explained the Edison system. He paid a high tribute to Mr. Edison for his electric light inventions. Among the experiments exhibited by the Professor were those of burning an Edison colored lamp in water, fusing safety-catches, breaking lamps wrapped in cotton cloth without igniting the cloth, and regulating the lights by means of resistance boxes. The experiments were received with enthusiasm on the part of the large audience present.

BOSTON HERALD. ANOTHER NEWSPAPER LIGHTED. The Boston Herald building, Boston, is being enlarged and the proprietors of the *Herald*, Messrs. R. M. Pulsifer & Co., have ordered a plant of one L dynamo and 250 ten candle lamps. The arrangement of the lamps will be 200 in the compositors' room, 35 in the editorial offices and 15 in the engine room. Before finally deciding to introduce the light, Messrs. Pulsifer & Co., inquired of Mr. George W. Childs of the Philadelphia Ledger, how the Edison light was working in his compositors' rooms, and received from him in reply a satisfactory endorsement of our light.

FALL RIVER. THE CONANICUT MILL TO BE LIGHTED. A plant of one K dynamo and 250 A lamps is being installed in the Conanicut Mills, Fall River. The lamps will be placed so that one lamp will light four looms.

AUGUSTA, GA. PLANT FOR COTTON MILL. The Sibley Manufacturing Company, Augusta, recently sent an agent North for the express purpose of investigating the different systems of artificial lighting and of reporting upon that best adapted for their cotton mill, said to be the largest of its kind in the South. He visited many manufacturing centres where electric lights are used in mills, and, after seeing our light in practical operation in many factories, reported in favor of the Edison system. The Sibley Company has accordingly given us an order. The plant is now being shipped and consists of two K dynamos with about 400 A lamps.

LONDON. AN ISOLATED PLANT ENDORSED. The following letter has been received, endorsing an isolated plant installed in London:

"MACINTOSH LANE, HOMERTON,
LONDON, July 19th, 1882.

THE EDISON ELECTRIC LIGHT CO., LIMITED:

GENTLEMEN:—In reply to your request, we take great pleasure in stating our experience of the Edison incandescent electric lamps. We believe ours to be the first factory in London that was lighted with your system, and are at present using 120 of your eight candle-power lamps with a few 16 candle-power lamps. These have now been running a matter of 1,490 hours, during which time only five lamps have given out, and these not until they had been burning a period of over 900 hours. We find the light from the same a great boon to us in our particular branch of business which is wire covering, and which at the present time we are exceedingly busy in, necessitating us to work both day and night, consequently, we gave your lamp a very severe test. The steadiness, brilliancy, etc. of the light all combine to make it a most desirable light for all manufacturers.

Yours truly,

PHILLIPS BROS."

PAISLEY, SCOTLAND. PLANT IN PRIVATE RESIDENCE. The following account of the plant installed in the residence of Mr. A. Coats, Woodside, Paisley, is taken from the Paisley *Express*, August 4th:

"By special invitation we had the pleasure last night of visiting Woodside, and were gratified at the sight presented. The entire house—dining-room, drawing-room, general rooms, bedrooms, conservatory, fernery, cave, &c., all of which we passed through—were lighted by the Edison incandescent electric light. We may here state that Edison's system has none of the drawbacks usually associated with electric lighting, such as intermittent shadows and unsteady and fitful illumination. There is emitted a well diffused light, which though brilliant and luminous, is not so intense as to be offensive to the eye. On the contrary, it is mellow, pleasing, and steady, without heat or smell. The work of introducing the necessary apparatus to Woodside has been in hourse for some time, and is now completed in a manner which is likely to give great satisfaction to Mr. Coats. * * * The chandeliers and gas brackets are retained in their places, and have been found perfectly suitable for the change that has been effected from gas to electric lighting. The engine is 12 nominal horse power, driving two dynamos, each supplying 75 A lamps. * * * The system within the house is very complete, and so perfect that by an arrangement of switches a whole suite of rooms may be brilliantly lighted or the illumination may be reduced to a single jet."

BOSTON. MANUFACTURERS AND MECHANICS INSTITUTE PLANT. The Edison Company will exhibit its system of lighting at the next Exhibition Fair, beginning early in September, of the New England Manufacturers and Mechanics Institute, Boston, Mass. The Edison exhibition will consist of one L dynamo, two K dynamos, about 650 16-candle lamps, a few 10 candle lamps, some 32-candle A lamps, a motor, meters, electric tubes for underground conductors, &c. The Babcock & Wilcox Company, New York City, will exhibit one of their tubular boilers, and Armington & Sims, Providence, proprietors of the Lawrence engine, will exhibit two of their engines, one 8x10 and the other 12x20. The boiler and engines will furnish steam and power for the Edison dynamos and will be used exclusively for that purpose.

NEW YORK CITY. THE BERKSHIRE TO BE WIRED. The Berkshire Apartment Association have given us an order to wire for the Edison light their new apartment building, corner of Fifty-second street and Madison avenue.

LONDON. EDISON LIGHTS FOR STREET LIGHTING. Mr. William Haywood, Engineer and Surveyor to the Commission of Sewers in the city of London, has published a report made by him to the Street Committee, on the results of the electric lighting of public ways within the city of London in 1881-82. It appears from his report, that the thoroughfares lighted by arc lights in London, were divided into three districts, each of them allotted to a different arc light company. Mr. Haywood's report is based principally on his examination of those three districts. The report states that whatever the excess of illumination given by the arc lights may be over that given by the ordinary street lamp, the value of the tests must be determined by practical considerations, such as (1) uniform distribution of light, best accomplished by small lights at small distances, (2) the avoidance of unequal distributions of light and deep shades and (3) the absence of flickering. Tested by these principles, the report states that the excess of light given by the arc lamps was much less valuable than might be supposed. In this connection, and, as may fairly be assumed, in illustration of the superiority of the Edison lamps for street lighting as compared with the arc lights, the report speaks as follows of the lighting of the Holborn Viaduct by the Edison Company:

"The Holborn Viaduct is at the present time lighted experimentally by the Edison Company, who have placed two incandescent lamps in each gas lantern, each lamp, as stated by the Company, giving about the same light as in ordinary gas lamp, and the two, therefore, double the light of the gas lamp disused. No lamp is more than 66 feet distant from another. There is scarcely any part of the Viaduct which is better lighted than another; there are no strong shadows to deceive the eye and the footstep; there is no flickering and no material variation in illuminating power, so far as can be noticed by the ordinary observer, and the Viaduct is, for all practical purposes, well lighted."

The Commissioners of Sewers, in token of the fact that the Edison light was found to meet the essential requirements of street lighting as set forth in the report, have contracted with the London Edison

Electric Light Company to light the Holborn Viaduct by means of Edison incandescent lamps for six months, at the same price as gas.

FIRE PROTECTION IN MILLS. Mr. C. J. H. Woodbury, Inspector, Factory Mutual Fire Insurance Companies, Boston, has just published a work, printed by John Wiley & Sons, New York, on the Fire Protection of Mills. A portion of the book is devoted to a discussion of electric lighting in factories, quite a full description being given of the Edison system. That subject is treated from a standpoint of fair and intelligent criticism on electric lighting as regards safety from fire, and the book is therefore a welcome contribution to the growing literature on that subject.

AMSTERDAM, HOLLAND. A CAFÉ LIGHTED. A plant of 60 A lamps was started July 7th, in the grand café of Messrs. Krasnapolsky and Company, Amsterdam. This restaurant is one of the largest in Europe, and is visited by two thousand people daily. Our light gives satisfaction, its brilliancy and steadiness being in marked contrast with the dull and flickering gas in an adjoining room which opens into the café with large folding doors.

APPLETON, WISCONSIN. MILLS TO BE LIGHTED. A plant of 250 lights has been ordered by Mr. H. J. Rogers, Appleton, to light several mills in that city, the dynamos to be run by water power.

CHILI. FLOUR MILL LIGHTED. A plant consisting of one E dynamo and 30 B lamps has been installed near Valparaiso, in the flour mill of Mr. Enrique Lanz, the largest establishment of the kind in Chili. With 30 lamps in circuit, the water consumption is said to indicate less than two horse power, at a speed of 1,300 revolutions per minute; and with a speed of 1,800 revolutions, they

say, they get 40 lamps at full 8-candle power. The length of the circuit is 510 feet. The machine runs 13 hours each day, and is in charge of an intelligent native miller.

HOLYOKE, MASS. THE GERMANIA PLANT. The plant in the Germania Mills, Holyoke, Mass., mentioned in the last Bulletin, was visited August 3rd, by a large number of manufacturers of cotton goods and paper, whose mills are in the neighborhood. Reports of the visit were published in the Holyoke *Transcript*, and the Springfield *Daily Union*. The latter paper says:

"The party were unanimous in their expression of satisfaction at the beauty, steadiness and safety of the system and several of its members showed their confidence in it by grasping the wires, where they were bared for the purpose, without the slightest disagreeable result. The lamps in this mill are of two sizes, the larger being equal to two, and the smaller giving the same light as one good gas burner, but the light emitted is much steadier, devoid of heat, and of such a character as to enable the operatives to distinguish indefinite shades with as great accuracy as under a noonday sun. During the evening the party visited the Merrick No. 3 mill, which is also lighted by this system."

The following extract is from the *Transcript:*

"The Germania Mills have adopted the Edison incandescent system of electric light, for their carding and spinning rooms and the apparatus has been adjusted and tested this week. Considerable interest has been awakened on this new illuminant, among the local manufacturers, since the Edison company placed one of their plants in the Little Hampden, or the Merrick mill No. 3 some four months since; and the results of the experiment have been closely watched and its success led to its adoption by the Germania company after careful investigation of the various systems of electric lighting. Their card room is at present lighted with lamps of 16 candle power each, and though less than half as many are used as there were of gas lights previously, the room appears nearly as light as day and the temperature scarcely higher then in the open air, and the atmosphere as free from vitiation as though the room was illuminated by the rays of the sun. * * * It is claimed that the Edison is the only electric lighting system that has never caused a fire. The light emitted from these lamps is soft, pure and absolutely steady, burning in a draught, or a motionless atmosphere, without the slightest fluctuation, far excelling gas in all of these qualities and radiating, it is claimed, less than one-fifteenth of the heat. * * * At the Germana mill the system is thus far giving the

highest satisfaction and it is probable that the whole mill will soon be lighted by this method."

DAVENPORT, IOWA. A NEWSPAPER PLANT. The Davenport Gazette Company has ordered a plant of 120 B lights for use in connection with the business of the Company, to light the composing-room of the *Gazette*, and to light the post-office. The plant will be installed at once.

CINCINNATI. A FACTORY PLANT. Messrs. James L. Haven & Company, manufacturers of hardware and agricultural implements, Cincinnati, Ohio, have ordered an L dynamo with 86 A and 64 B lamps, to light a portion of their works. The plant will be installed at once.

DANGER FROM GAS. Mr. William Crookes, F. R. S., London, says that with the use of gas "the ceilings get blackened, the curtains are soiled with soot and smoke, the decorative paint-work is destroyed, the gildings tarnished, the bindings of the books rotted, and the air of the room is not cool and fresh, but vitiated by the hot fumes from burnt or semi-burnt gas." * * * The London *Times*, July 8th, reports that the base of a big gas lamp at the bottom of Preston New-Road, Blackburn, blew up July 7th, with a loud report. The lamp leaked and exploded when it was lighted. Surrounding buildings were shaken, and huge stones hurled thirty feet into the air. Mr. Whittaker was killed. Mr. Beardsworth and Mr. John Fielding were dangerously injured, and others passing by were slightly injured. This gas lamp had been set up to compete with the electric light. * * * The President of the Royal Society in his evidence before the Parliamentary Committee, at London, has recently stated that he likes the electric light because it saves his fixtures and books from disfigurement and does not befoul the atmosphere. * * * A gas explosion took place in a café in Paris, July 12th, killing over twelve persons

and wounding nearly fifty, including a commissaire of police, a captain of the firemen, 17 firemen of the rank and file, and several sargents de ville. Early in the morning an escape of gas was noticed followed by a slight explosion. The proprietor of the café, where it took place, instantly started to have the matter attended to. Hardly had he gone when a terrific explosion occurred in the cellar, blowing the whole of the building to atoms. * * * Mr. Griswold, the *Times* says, thinks the fire, August 16th, in his hotel at No. 10 Thirtieth street, New York City, was caused by gas leakage. * * * C. D. Miller was found, July 6th, in a dying state on his bed in the Cosmopolitan Hotel, New York City, suffering from asphyxia caused by inhaling gas and the gas was found turned on. * * * Mr. Wright, receiving teller of the Mechanics National Bank, Wall Street, New York, was knocked down and burned on the face and hands, August 3rd, by an explosion of gas which had escaped and filled the spaces between the doors of the bank vault which Mr. Wright was opening with a candle in his hands. * * * William Henry Preece, F. R. S., in an article on the "Age of Electricity," published in the May number of *Time*, London, speaks as follows of the objections to gas:

"The objections to gas are very serious. In the very act of producing light it also produces water, and this water is found of great detriment to delicate objects that are exposed in shop windows. It not only produces much heat itself, but it throws into circulation the heated products of combustion. It also produces various gaseous acids which act injuriously upon gilded ornaments, and the ornamental bindings of our books and picture frames, and which are sadly detrimental to the air we breathe. It hastens the decay of many materials, and its influence on brass is well known in the frequent falling of pictures when they are hung by means of brass wire. Again, its fitfulness or variation is destructive to the eyes, so that constant writing, reading or studying by its means has proved injurious; in fact, it is questionable whether it has not led more to shortsightedness than any other known cause. It, moreover, introduces into our houses a certain source of danger, taps are left unturned, meters get out of order, gas escapes into our rooms, and when it mixes with air in certain proportions it produces one of the most explosive agencies known, and wrecked houses and lost lives witness to this unfavorable side of the use of gas."

ANAMOSA, IOWA. STATE PRISON PLANT. A plant consisting of 300 lamps is being installed in the Iowa State Prison at Anamosa.

MILAN. CENTRAL STATION PLANT. The Italian syndicate controlling the Edison light for Italy has purchased ground for the first central station in Milan. The property, for which the syndicate paid 300,000 francs, consists of a building known as the Theatre of Sa. Radegonda. The main hall, where the steam dynamos will be placed, is a room 140 x 45 feet. The City Government of Milan have already granted to the Edison syndicate the right of way through the streets, and underground conductors connecting the central station with the buildings of consumers will be laid at once. The most important places first to be lighted are the theatre La Scala, where 1,000 lamps will be used to illumine the stage alone; and the shops of the Galleria Vittorio Emanuele. Professor Colombo, of the Royal Polytechnic School of Milan, and the Technical Director of the Edison Italian syndicate, is now in New York City supervising the shipment of the central station plant to Milan. Three steam dynamos, the same as are used in the Pearl Street station, New York City, have already been shipped, and the rest of the equipment is being forwarded as rapidly as possible.

PHILADELPHIA. PROPOSED EDISON RAILWAY IN FAIRMOUNT PARK. The following extract is taken from the report of Superintendent Thayer to the Fairmount Park Commission, June 27th, in response to the instructions of the Commission directing Mr. Thayer to inquire into and report upon the practicability of constructing and operating an Edison Electric Railway in West Fairmount Park. The following extract is taken from the report:

"In order to assure myself of the practicability of the proposition which has been presented for your consideration I visited Mr. Edison's works, at Menlo Park, and carefully inspected the electric road which he has in opera-

tion at that place, and which is 2½ miles in length. As a description of this remarkable adaptation of recent discoveries in electricity to a useful purpose, may be of some interest in this connection, and as I was directed to report upon the practicability of the matter, I will endeavor to explain it briefly. The motive plant consists of a steam engine, of 100 horse power, and 5 dynamo-electric machines, capable of generating currents of great quantity but very low intensity. These machines are placed in a building, at Menlo Park, and are connected with the rails of an ordinary railway track about half a mile from the works by an insulated copper cable laid underground. The power developed by the stationary steam engine puts in motion the armatures of the dynamos above referred to, and the rapid revolution of the armature in the 'fields' of the large electro-magnets develops the currents, which being taken from the 'commutator' by brushes suitably arranged, are transmitted from thence by the cable to the rails of the track. By this means the energy originally developed by the combustion of the coal under the boilers of the steam engines is transmitted to a distance and placed in the rails of the track. It now simply remains to reconvert this energy into useful work and to cause the cars to move. This is accomplished in the most simple manner by a reversal of a portion of the operation as follows: A dynamo-electric machine is placed under the car and is connected electrically with the wheels. The current passes from the rails of the track to the wheels of the car, from thence to the dynamo. The armature of the latter is thus at once put in rapid motion, and by a simple and efficient mechanical arrangement the motion thus developed is transmitted to the wheels, which serve as drivers, and the car is propelled along the track at any rate of speed that may be desired, depending simply upon the horse power of the dynamo engines used. The practicability of the matter, as far as the power proposed to be used is concerned, is thus seen to be assured."

ROCHESTER. SMALL PLANT ORDERED. A plant consisting of one E dynamo, 15 A lamps, to be in operation by September 1st, has been ordered by the Eastman Dry Plate Company, Rochester, N. Y. This company manufactures dry plates for photographers, and uses chemicals of an explosive nature rendering gas or oil lamps dangerous. The use of the Edison lamp will avoid this danger.

POTTSTOWN. PLANT FOR THE IRON COMPANY. The Pottstown Iron Company, Pottstown, Pa., has ordered a plant of one Z dynamo and 60 A lamps. The paths and roads around their

shops will be lighted with 30 of these lamps, about 10 will be placed in the offices, and the remainder will be placed in two dwellings, situated about 1,400 feet away from the dynamo, the wires being run on poles.

LAWRENCE, MASS. AN EDISON COMPANY FORMED. A company has been formed to introduce the Edison light into Lawrence. The officers of the company are F. E. Clarke, President; E. H. Lord, Secretary; and James H. Eaton, Treasurer.

LUDINGTON, MICH. SAW MILL LIGHTED. Mr. O. N. Taylor has ordered an E dynamo of 20 lamps (only 15 to be burned at a time) to be installed in his saw mill at Ludington.

DANTZIC, PRUSSIA. NAVY YARD PLANT. Contracts have been signed to light a portion of the Navy Yard at Dantzic, the lights to be in operation by October first.

HOLYOKE. PAPER MILL PLANT. The Whiting Paper Company, mill No. 2, Holyoke, Mass., one of the largest paper mills in the country, have ordered a plant consisting of one Z dynamo and 120 B lamps. The dynamo will be run on an independent engine, and the plant will be installed at once.

MANCHESTER, ENGLAND. THE IRONWORKS AGAIN. The following account of the plant, mentioned in the Eleventh Bulletin, now running in the Salford Ironworks, Messrs. Mather & Platt, Manchester, England, is taken from the Manchester *Guardian*:

"The electricity is induced from two dynamo-electrical machines, each of 60-light power and driven by a small single-cylinder engine of six nominal horse power. The conductors are carried from the dynamos, which are placed on the ground floor, through two workshops containing all kinds of engine

tools, fitters' benches, &c., and through a suite of offices and draughtsmen's rooms. At present the workshops have 81 lamps in a circuit, and the offices 53, making a total of 134. * * * The most pleasing example of electric lighting is to be seen in Messrs. Mather and Platt's offices, which are illuminated by means of single jets and chandeliers. A soft and steady light, much more pleasant to the eye than that given by gas, is diffused over the rooms, and no smell and little or no heat is produced. We believe Messrs. Mather and Platt are so satisfied with the partial application of the Edison light that they intend to adopt the system throughout their extensive works, where upwards of 1,000 lights are required."

BRAZILIAN PATENT LAWS. The *News*, Rio de Janeiro, June 14th, contains an article on the present attitude of the Brazilian Government towards electric light patents. The Legislature is at present indisposed to grant protection to electric light inventions, consequently the Edison electric light system cannot yet be exploited in Brazil without imperilling the patents applied for. The following extracts are taken from the article in the *News*:

"The success which is attending the use of the electric light in various countries leads once more to the pertinent inquiry: When is Brazil to open her doors to this beneficent invention? * * * Desirable as a new law certainly is, there is little or no probability of its adoption for a long time, and in the meantime it is proposed to deny privileges to this invention and to deny its use to the people unless the inventor chooses to forfeit his rights of exclusive property in it. If we assume that the restriction is right, then it is most unfortunate both for the inventor and for the people that it is enforced just at this time and in connection with this improvement. * * * The invention is now outside the realm of experiment; it is a proved success, a recognized improvement of incalculable value in the daily life of the world. And yet, the people of Brazil are asked to wait until their legislators can frame a new law before they can take advantage of it! No government nor interest has any right to stand in the way of progress, nor to deny to a people the benefits growing out of any discovery or invention, whatever it may be. That, however, is just the position occupied by the present national legislature of this country."

BRAZIL. PAMPHLET ON THE EDISON SYSTEM. The Engineering Club of Rio de Janeiro, have published in Portugese a pamphlet of eighty pages on the Edison System of Electric Illumination. It contains among other things the report and opinion on

the Edison system made by the Commission appointed by the President of the Council, in session January 2nd, 1882, composed of the associate engineers Messrs. Aarao L. de Carvalho Reis, Ivao Raymundo Duerte and José America dos Santos. The description of the Edison light is accurate and complete and shows a just appreciation of its merits. Copies of the pamphlet will be furnished upon application at this office.

CINCINNATI. A DISTILLERY PLANT. The Mill Creek Distilling Company of Cincinnati, Ohio, have ordered a Z dynamo and 60 A lamps. They have never been able to use any artificial light in the room where re-distilling is done, because the alcoholic vapor takes fire and explodes. The Edison lamps to be used in this room will be enclosed in a glass globe of water, a little larger than the lamp itself, thus avoiding that danger.

PARIS, FRANCE. DRY GOODS STORE PLANT. The well known dry goods store, Au Bon Marché, Paris, is now being wired for 500 Edison lamps. The proprietors, MM. Boucicault et Fils, have tried with dissatisfaction the arc lights, and have discarded them to try the Edison.

EDISON LIGHT FIXTURES FOR HOUSES. A LARGE FACTORY BOUGHT. The manufacturing of house fixtures and appliances for the Edison light has rapidly developed into a large business. Messrs. Bergmann & Company, mentioned in the last Bulletin, are at present foremost in this new enterprise. Finding their present shops, No. 108 Wooster Street, too small to keep pace with their orders, they have just purchased the large factory of the United States Electric Light Company, located at the corner of avenue B and east 17th street, together with the entire plant of boilers, engine, shafting, etc. The building, elaborately equipped

by the United States Company for the manufacture of Maxim lamps and dynamos, is over 90 feet square, contains 6 floors lighted from all sides, with very high ceilings, has a superficial area of about 50,500 square feet, and contains two large tubular boilers, a Corliss engine of 150 horse power, a large Knowles steam pump, a Worthington duplex steam pump, a pressure tank, elevator, a six ton Howe platform scale, complete water, steam and heating apparatus, main jack shafting on each floor, including pulleys and belts, also two complete lines of shafting on each floor with pulleys for running lathes, presses, machines, etc., together with all gas and office fixtures, railing, shelving, etc., all of which have been sold by the United States Company to Messrs. Bergmann & Company. They will at once take possession, and, by an arrangement with our company, manufacture Edison fixtures and appliances on a scale commensurate with the progress of the Edison light.

TESTIMONIAL FROM W. H. PREECE. Mr. W. H. Preece, F. R. S., the engineer of the British Postal Telegraph, and Commissioner of the English Government at the Paris Electrical Exposition, has written the following letter to Mr. Arnold White, Secretary of the Edison Company, London, regarding the plant installed in the House of Assembly, Cape Town, Cape of Good Hope, mentioned in the Twelfth Bulletin:

"Dear Sir:—You are aware that the Cape Government decided upon applying the electric light to their House of Assembly, and after an unsuccessful trial of the arc system, they instructed me to send out the best incandescent system. I selected the Edison one. The House was lit up on May 11th, and Mr. Sivewright, the general manager of telegraphy in the Cape, writes: 'The Electric Light in our House of Assembly has been a perfect 'success. Everything has gone off capitally, and from the day that the light 'was first started there has been no hitch of any kind'. I am sure this will be satisfactory to your Directors.

Yours faithfully,

W. H. PREECE."

NEW YORK CITY. ANOTHER PLANT FOR MR. EVERETT. The Hotel Everett, 86 Chatham Street, has been lighted for several months with a plant of about 100 lights, as was stated in the Fifth Bulletin. The light has given such satisfaction that Mr. Everett has given an order for a much larger plant, two L dynamos and 250 A lamps, together with a few 32-candle lamps for out-door illumination, to be installed in Everett's Hotel, Vesey and Barclay Streets. The front of the Hotel Everett has been lighted with two street lamps composed of clusters of Edison 16-candle lamps, but the out-door lamps for Everett's Hotel, to be placed in globes attached to lamp posts made for the purpose, are to be of 32-candle power, and are to be so arranged as to light the sidewalk in front of the hotel. The interior lamps, 16-candle power, will be distributed in the halls, offices, dining room, parlors, and elsewhere on the first floor of the building.

ST. PETERSBURGH, RUSSIA. RESTAURANT PLANT. A contract has just been concluded to light the Restaurant Dejeune at St. Petersburgh with a plant consisting of 3 Z dynamos and 180 A lamps.

EDISON FACTORY IN FRANCE. Owing to the fact that under the French patent laws, lamps, dynamos, meters, and all other apparatus constituting the Edison system and covered by Edison's French patents, must be manufactured in France, there has necessarily been some delay in starting our light in that country, pending the equipment and starting of factories. The European Company's factory at Ivry-sur-Seine, however, is now finished, and Mr. Batchelor has commenced to turn out dynamos, lamps, etc. Consequently the French Company has now begun to install plants in Paris, as well as elsewhere in France. The following account of the factory is taken from the London *Electrician*, August 12th:

"The Edison Company have now completed the establishment of a factory for the manufacture of their dynamos, lamps, &c., in Paris. Owing to the laws of the country it was absolutely necessary to establish a factory where everything appertaining to the system could be manufactured, as if any foreign article is imported into France and sold, the patents obtained for it become void in that country. This obstacle to the introduction of the Edison system has now, however, been surmounted, and we are informed that several plants are being laid down in different parts of the country. The factory, as established, consists of three principal departments: First, the machine works, where the dynamo machines, resistance boxes for the regulation of the magnetic field, together with all the necessary lamp fixtures are made. Second, the lamp factory, which consists of the glass department, where all the glass parts of the lamp is made; the fibre room, where the fibres are cut and finished, which when carbonized make the carbons for the lamp; the clamp room, where the clamps which hold the carbons in the lamp are made; the plating room, where the carbons are plated on to the clamp, so as to insure good contact; the pump room, where the air is exhausted from the globes; and lastly, the testing room, where all lamps are tested and marked. Third, the electric tube works, where all the underground mains are made, together with the junction boxes, safety boxes, &c. The lamp factory at present has a capacity for turning out 1,000 lamps per day. There are over 300 men employed at the works. Mr. Batchelor is manager, and is assisted in the machine works by Mr. D. Cunningham, who was master mechanic at the Edison machine works in New York."

BUDA PESTH, HUNGARY. POST OFFICE LIGHTED. The post office and telegraph authorities at Buda Pesth have expressed themselves as satisfied with the installation of our light, which has been running all night for three months without giving any trouble. Previous to adopting our light they had tried other electric lights but without success. They state they will make our plant permanent.

RIO DE JANEIRO. The Dom Pedro Railway Station has been lighted for several months with one of our plants. The illumination was recently inspected by the Emperor of Brazil, and the following account of his visit is taken from the *Globe*, Rio de Janeiro:

"Night before last the promised exhibition of the Edison system of electric light took place at the Dom Pedro Railway Station. There were present the

Emperor, the Princess Imperial, the Minister of Agriculture, Count Blapendy, Counsellor Leitao da Cunha, and many others. The Emperor and suite arrived at the Station at 8.30 P. M., and were received by Dr. Herculano Penna, director of the railway, Mr. Rademaker, chief of traffic, Dr. Aarao Reis, chief of telegraphic service, Messrs. Robinson and Lilva, Counsellor Galvao, inspector of public lights, the committee of the Club of Engineers, and other citizens and public functionaries interested in the experiments, which were conducted on the extensive platforms of the station, under the direction of Dr. Reis and of C. H. McCarty, the representatives of Mr. Edison. Experiments were made with the Edison light first, then with gas, the Edison Company using 56 whole lamps and 4 half lamps, which, since the 10th, of Febuary have been continuously lighted 675 hours. The electric current was generated by the dynamo which was sent out by Mr Edison for exhibition at the Brazilian Industrial Exposition. * * * The superiority of the Edison light was generally recognized, particularly by the Emperor. Mr. McCarty, to show the insulation of the flame and the almost entire freedom from risk of fire, broke one of the glasses while wrapped in a piece of cambric. This light texture was unhurt notwithstanding its proximity to the flame. The experiments terminated at 9:40. The Central Station will continue to be lighted until next Sunday with the same lamps. At the close of the exhibition, Dr. Reis presented the Count d' Eu with a box containing all the apparatus for producing the Edison light."

MR. EDISON'S PATENTS. The *United States Patent Office Official Gazette*, Volume 2[illegible], July to December, 1881, just published, shows that within the six months covered by this volume of the *Gazette*, 96 patents were issued for different forms of electric lights, including the arc light, dynamos, lamps, meters, &c., and that 48 of these patents, being one half of the total number issued, were granted to Mr. Edison.

NEW ENGLAND DEPARTMENT FOR THE EDISON LIGHT. The rapid increase of our business in New England has compelled us to form a separate department for that territory, consisting of all of New England except that portion of Connecticut lying west of the Connecticut river. Mr. Spencer Borden, Treasurer and Superintendent of the Fall River Bleachery, has resigned his position in the Bleachery to accept the position of General Manager, at Boston, of this New England Department of the Edison Electric Light Com-

pany. He will be assisted by Mr. Sidney B. Paine and Mr. Jefferson Borden, Jr., both of whom have been associated with him at Fall River, in connection with his management of the Edison light interests in and about Fall River; also by Mr. William H. Dwelly, Jr., who leaves his position as clerk of the Fall River Bleachery to assume a similar position under Mr. Borden in his new office at Boston. In this connection the following extract from the Fall River *News*, August 23d, will be read with interest:

"At a meeting of the Directors of the Fall River Bleachery, held this forenoon, the resignation of Mr. Spencer Borden, Treasurer of the corporation, was accepted, and Mr. Norman E. Borden, Manager of the Lonsdale Bleachery, was elected to fill the vacancy. Mr. Spencer Borden has been elected Manager of the New England department of the Edison Electric Light Co. The rapid increase of the business of this Company has made it necessary for them to organize a department for New England, with headquarters in Boston. An office will be opened there about Sept. 1st, simultaneously with the opening of the Manufacturers' and Mechanics' Institute Fair, where the Edison Company will have a fine exhibition. In the business of this department there will be associated with the Manager Messrs. Jefferson Borden, Jr., Sidney B. Paine and W. H. Dwelly, Jr., also from this city, the latter leaving his position as Clerk of the Bleachery to assume the duties of his new position. * * * Mr. Borden, who now retires from the management of the Bleachery, organized the Company some ten years ago, and has been its Treasurer ever since. The establishment under his management has been a success, and he now retires with the regrets of the Directors."

WILLIMANTIC LINEN COMPANY. PLANT ORDERED. The Willimantic Linen Company, Willimantic, Conn., have ordered a plant consisting of one Z dynamo and 60 A lamps to light one of the rooms of one of their mills, for the purpose of making a practical test of the Edison lamp for their work.

PHILADELPHIA. THE LEDGER PLANT AGAIN. Our plant in the composing rooms of the *Ledger* has proved so satisfactory that the lamps have been introduced also in their publication office, which was lighted for the first time with the Edison light, July 12th. The *Ledger* of July 14th, contains the following account of our plan:

"The Edison electric light, which was introduced into the composing room of the PUBLIC LEDGER on May 10th, proved so satisfactory that it has been extended to the publication office, where the public may see it in actual use, and arrangements have been made to extend it to other parts of the building. Except during the week from May 30th, to June 7th, the light in the composing room has been in continuous use for nearly two months. The stoppage took place while an extra dynamo machine was being put in place, more lamps having been put up than were at first contemplated. At present the current is furnished by two 60-light machines, driven either by the main engine or by special engine from a countershaft, this arrangement having been made by the Superintendent of Machinery, to provide against a possible break-down of the special engine. It is in accordance with a system of duplication of machinery carried throughout the mechanical department of the LEDGER office.

In the publication office, as in the composing room, each gaslight formerly in use has now its corresponding electric lamp of what is nominally the same candle power. The gas fixtures remain in position subject to use. For the publication office chandeliers have been specially designed by the Superintendent of Machinery to meet both the requirements of the insurance companies as to the laying of electric wires and the requirements of the LEDGER office. There are three gas chandeliers of six lights each, hung from a ceiling panelled in hard woods. The conducting wires were carried on the ceiling so as to be concealed from view, and, as they could not be carried down on the gas chandeliers, under the Insurance regulations, burnished brass drops were made, encircling the chandeliers and stayed to them by ornamental wooden clamps, about two and a half inches in length. Each of the three drops carries within it the wires for two lamps, which branch out from the bottom between the gas jets and increase the diameter of the chandelier about six inches. The lamps, six to each chandelier, hang downward, and have above them flat white glass shades or reflectors. The cashier's, clerks' and bookkeepers' lights are arranged on brackets and stands similar to the gas fixtures heretofore used by them, and a movable desk light, supplied by gas through flexible hose, is matched by a movable electric lamp, supplied with electricity through a wire cable.

There are twenty-seven lamps of sixteen candle-power each in the publication office all controlled by one key on the main circuit, as well as by separate keys on each lamp, and the whole system is also provided with a series of "safety-catches"—an arrangement of strips of lead wire in the circuit, which will be burned out (thus breaking the circuit), if the current rise so as to threaten danger from overheating of the wires. * * * The whole number of lamps now in use in the LEDGER office is 112, of which 98 are "A" lamps of sixteen candle-power, and 14 "B" lamps of 8 candle-power, or an equivalent of 105 sixteen candle power lamps.

The two 60-lamp dynamo machines now in use are to be replaced in a short time by a 250-light machine, which has been delivered and will be set

up as soon as the work can be done without interruption to the light. This would be a serious inconvenience in the composing room now that the compositors have become used to the purer and cooler air which the electric light secures to them. Accurate information of the cost of the electric light under this system cannot yet be given, but it is believed to be cheaper than gas and is known to be much more satisfactory in other ways."

LIFE OF LAMPS. The life of our lamps can best be estimated in cases where a fixed number are lighted and extinguished together; a record being kept of the time of burning and of the number of breakages, and broken lamps as fast as they give out being replaced by other ones. The rule for finding the life is to multiply the hours the lamps burn by the number of lamps and divide by the number of breakages. The life depends upon the candle power at which the lamp is burned. Thus if a B lamp (eight candles) is placed on a circuit for an A lamp (sixteen candles), the B lamp will be intensely brilliant but it may last only a few seconds. If, on the contrary, an A lamp is placed in a B lamp circuit, the former will hardly glow and it will last forever. From this it will be seen that the life of the lamp depends on the candle power it is made to give. But there is another item to be considered, namely, the number of lamps per horse power. If an A lamp current is used upon a B lamp, the quantity of current sufficient to supply three A lamps, or give forty-eight candles, would bring the B lamp up to 600 candles; more than twelve times as much light as is obtainable from the same unit of current in connection with the three A lamps, and equivalent to about fourteen hundred candles per indicated horse power. But in that case there would be a vast difference in the life of the lamps. The three A lamps would last, while the B lamp would die in a few seconds. As regards a B lamp current, if an A lamp is placed in a B lamp circuit, the result would also be very uneconomical. With the power that would be sufficient for one third of a B lamp, or in other words to illumine a B lamp to a brightness of three candles, the A lamp would give

only about one fortieth of a candle, which would be equal to only one candle per horse power; but the A lamp would last for years. Between these extremes, Mr. Edison has chosen a mean, so as to give the consumer the most economical lamp. This was attained by the study of a vast amount of data obtained by experiments with many thousand lamps extending over many months. The number of lights of sixteen candles each that can be obtained for a horse power of electricity, (provided the energy or power furnished to run the dynamo is entirely steady), is shown below in the column marked I, while the hours that these lamps will last is shown in column II.

I	II
13½ per H. P.	42 hours
8½ " " "	2,240 "
5⅓ " " "	35,000 "
1 " " "	Practically permanent.

By estimating the cost of lighting a room with 2[illegible] lamps for 1,000 hours, it will be seen if the estimate is made on each of the four conditions above given, that Mr. Edison has struck upon a wise mean between two extremes. For the purposes of the estimate, power may be taken at one cent an hour, and the cost of the lamps may be assumed to be one dollar each, there being moreover no difference between the cost of an A and B lamp.

Taking lamps at 13½ per H. P.

Power costs - - - - - -	$ 14 81
Lamps cost - - - - - - -	476 19
	491 00

Taking lamps at 8½ per H. P.

Power costs - - - - -	$ 23 53
Lamps cost - - - - - - -	8 93
	32 46

Taking lamps at 5⅓ per H. P.	
Power costs . . .	$ 37 51
Lamps cost	57
	38 08
Taking lamps at 1 per H. P.	
Power costs	$200 00

These tables show the need of regulating lamps carefully, in order to obtain the best results both of life and of economy of power; and the practical instruction to be drawn from them may be summed up as follows: First, if a consumer desires an increased quantity of light, it is cheaper to add more lamps than to force lamps to an increased incandescence; second, if power is cheap, lower economy lamps can be used, that is to say lamps requiring a larger quantity of horse power, than when power is dear; third, if power is so cheap as to cost almost nothing, as in the case of some water power, an A lamp may be made, which, at one lamp per horse power, would last forever; and, fourth, while it is true that a few lamps per horse power last longer (thereby economizing in lamps at the expense of horse power), and that many lamps per horse power last shorter (thereby economizing in power at the expense of the lamps), it must be remembered that the important thing is to strike the happy mean, namely, the longest possible life with the least possible consumption of power and investment. It is this which Mr. Edison alone has accomplished.

No. 14.
OCTOBER 14, 1882.

FOURTEENTH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the Vice President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

New York, October 14th, 1882.

FIRST DISTRICT, NEW YORK CITY. This plant was started and the district lighted up for the first time at 3 P. M. September 4th. Since then the station has been running day and night without stopping. The statement was made in the last Bulletin that up to that time no serious obstacle had been met with. The same is true now. Indeed, we can go further and say, that as regards Mr. Edison's part of the work, namely, the electric apparatus and every thing appertaining thereto, the result has exceeded our anticipations, the only delay that we have had having been caused by purely mechanical matters, such as the regulation of engines, and other usual engineering annoyances incidental to starting for the first time a number of high-speed engines. We are at present lighting 85 houses, wired for 2,323 lamps, and as soon as certain adjustments now being made in the steam engines are completed, we shall connect other houses as fast as possible.

Predictions have been made by parties unacquainted with the details of the Edison system, that the attempt to send electric currents by means of underground conductors over the large area covered by our First District would fail. An anonymous correspondent, in a letter published recently in the leading gas journal of the country, made the distinct assertion that our underground conductors had actually proved a failure. The letter, copied widely in other newspapers and commented upon generally by the press, was published in the *American Gas Light Journal*, New York City, October 2d, and is as follows:

"WASHINGTON, D. C., September 27th, 1882.

TO THE EDITOR AMERICAN GAS LIGHT JOURNAL: —

Thinking the old adage may be true, that 'you have to go from home to learn the news,' I beg to acquaint you with the substance of a conversation I have just had, with an electrical inventor of no mean capabilities, concerning Mr. Edison's alleged recent triumph. His information was derived from an electrician just returned from New York, who, as I understood, was summoned to your city for consultation on the subject. My informant stated that Mr. Edison had just met with the greatest disappointment of his life—the complete failure of his attempt to light 2,500 houses with his incandescent lamps by his underground system of wires; but fifty houses could be lighted, the electricity being conveyed away owing to imperfect insulation. As the insulation was supposed to be perfect, the conclusion is that underground conductors cannot be made to work.

Very respectfully, X."

The correspondent (name not given) says his informant was an electrical inventor (name not given), who obtained his information from another electrician (name not given). Is there any truth in it? None. No electrician was ever summoned, none ever came, we never thought of lighting even half of 2,500 houses, more than 50 houses are lighted, the electricity is not conveyed away owing to imperfect insulation, the underground conductors are not a failure, and Mr. Edison instead of being disappointed with them is even better satisfied than he ever expected to be. Such are the facts briefly stated.

As to insulation in general, the evil of leakage is greatly exaggerated.

Ordinary insulation is good enough, provided the materials do not deteriorate with exposure to moisture and air. This subject was fully treated by Mr. Clarke, in his report on underground conductors and insulation, to the Judiciary Committee of the Rhode Island Senate, printed in the Eighth Bulletin.

As to insulation in our First District, the total net-work of conductors is over 79,000 feet. They were manufactured in lengths of 20 feet, and each length was rejected that did not, on careful test, show a resistance of at least 150,000,000 ohms. Applying the same test to the entire net-work as was thus applied to each length of 20 feet, equally perfect resistance would be about 37,974 ohms; and the total leakage in the entire net-work about 141 foot lbs. per minute, or .00427 of one H. P. The conductors have now been under ground, on an average, nine months, and have been in constant use about 40 days. Our tests show that their efficiency as regards insulation is but a trifle below the theoretical efficiency exacted from each length tested as above, and that the loss of current, when the First District is in operation at the maximum, will be equivalent only to seven-thousandths of one lamp, or, in other words, to 48-millionths of one per cent. This loss from leakage is so insignificant that were we to light the entire city of New York with, say, four hundred thousand lamps, the whole loss of current from leakage (taking the actual results in the First District as a basis) would hardly amount to enough current to run a single lamp.

From the above statement it will be seen not only that the evil of leakage in general is greatly exaggerated, by inexperienced electricians, but also that the extent to which we suffer from that evil in our First District is infinitesimal.

THE YACHT NAMOUNA. The plant on Mr. Bennett's yacht, Namouna, was highly complimented in the New York *Herald*, September 8th. The article states that the lights "were in constant

use during a cruise from New York to the Canary Islands, Madeira, Gibraltar, Algiers, Palermo, Malta, Constantinople, Alexandria and Brindisi, occupying in all upwards of two months time;" and that "for continuous burning, freedom from flickering, absence of heat and odor, and for practical working and ease in handling they proved entirely satisfactory."

THE EDISON LIGHT IN THE TELEGRAPH OFFICE, LONDON. We quote below an extract taken from the London *Times* of August 22d, giving an account of the installation of the Edison light in the "Press Department" of the Telegraph office:

"Last night there was an important installation of the Edison electric light in the "Press Department" of the telegraph office, St. Martin's Le Grand, and the work thus carried out solves what have hitherto been considered some difficult problems in the question of electric lighting. The first interesting fact is that the lighting is part of a "system" supplied at a distance from the place lighted, the Edison Electric Light Company having its centre on Holborn Viaduct. The extension to the top room of the General Post Office, which was accomplished last night, is the greatest yet made from that centre, the distance from the dynamo-room of the company's office to the "Press Room" of the General Post Office being 1,950 feet. * * * The "Press Room" to which the Edison electric light has thus been supplied is a very busy part of the telegraph department (1,200 persons being employed there), which occupies the whole upper floor of the western building in St. Martin's Le Grand. The buildings, in fact, are hives of industry night and day. The post office authorities have long been alive to the necessity of replacing gas by electricity, and have tried more than one so-called "system". The proved danger of fire from one, and inconvenience arising from the necessity of having a special engine in another, with other practical difficulties proved in the working, led to their discontinuance. Under the advice of Mr. Preece, the electrical engineer of the post office, the Edison system was attached, and last night commenced its working. The first lighting was soon after 8 o'clock, and when the gas in the press room was extinguished a turn of the switch lighted up 59 incandescent lamps, of the well known pear-shaped pattern, with the carbon of the shape of an elongated horse-shoe. The effect of the change was very marked. In the telegraph room the atmosphere was heavy and heated. In the room lighted by the Edison lamps an even light without any shadow was thrown over all the tables, while the atmosphere, previously heated by gas, sensibly diminished, even in the short space of about 20 minutes."

EDISON LIGHT IN A RAILWAY STATION AT PARIS. A plant of 180 A lamps is installed in the St. Lazare Station, at Paris, of the Western Railway of France, and has been in successful operation for the past three weeks, giving great satisfaction to the Railway Company and to the public. The lights are distributed in the waiting rooms and in one of the principal passages. This experimental installation is made by the Western Railway Company with a view to the introduction of the light in all the stations of the Company.

CONTRACTS CLOSED BY THE WESTERN EDISON LIGHT COMPANY AT CHICAGO. The following orders for isolated plants have been taken by the Western Edison Light Company:

(1). A plant consisting of 2 L dynamos and 310 A lamps for Messrs. C. W. & E. Pardridge & Co. The light is to be used in two dry goods stores on State Street, Chicago, one being known as Pardridges', and the other as the Boston Store.

(2). A plant consisting of one K dynamo and 250 A lamps for Mr. H. D. Smith, Appleton, Wisconsin, to be used for the purpose of lighting the residences of Mr. H. D. Smith and of Mr. A. L. Smith; also the Appleton Blast Furnace, A. W. Patten's Paper Mill, Fleming's Linen Mill, and the Appleton Woolen Mill.

(3). A plant consisting of 1 E dynamo and 15 A lamps, to be installed in the Norton Flouring Mills, owned by Norton, Brother & Co., and located at Madison Street Bridge, Chicago.

(4.) A plant consisting of 506 lamps in the Empire Brewery, Best Brewing Company of Milwaukee, Wisconsin.

(5). A plant of one K dynamo for the North Western Manufacturing and Car Company, thereby doubling their present plant.

(6.) A plant of one Z dynamo and 60 A lamps for the saw mill of Messrs. Butters, Peters & Co., Tallman, Michigan.

TESTIMONIAL FROM BUDA PESTH. We have received the following testimonial from Buda Pesth, relating to the building occupied by the Minister of Post and Telegraphs:

"BUDA PESTH, July 20th, 1882.

I, the undersigned, certify by these presents that Mr. Francis Puskas has made experiments in lighting at the Ministry of Posts and Telegraphs, in three salons of the operators, the great staircase, the public salon and the vestibule of this salon by means of 40 A and 40 B incandescent lamps of the Edison System, from the 20th of May to the 10th of July current, every day from eight o'clock in the evening to five o'clock in the morning; that these experiments have been a success from every point of view. The installation which was very nicely made has been in operation during all the time without any irregularity, and we have found as a special advantage that the light of the lamps was soft, constant and in no way disagreeable to the organs of vision. The heat emitted by these lamps is so little that it is not to be taken into account.

It is for these reasons that this system of lighting has obtained the unanimous approbation of the direction and of all the employees.

LOUIS KOLLER,

Ministerial Counsellor and Director in-chief of the Department of Telegraphs.

STORAGE BATTERIES. The following letter, published in the New York *Herald*, September 23rd, 1882, is of interest:

"TO THE EDITOR OF THE HERALD:—

In an article entitled 'Electric Lighting,' published in your editorial columns, 19th inst., referring to the use of the Faure accumulator, occurs this statement:—

'Having once pumped the accumulators full, the running of the generating engine for an hour a day is all that is required to keep fifty lamps of sixteen candle power in full operation for six hours.'

So much interest is felt by the public in matters relating to electric lighting that a statement so calculated to mislead should be corrected at once. The fact is that a dynamo-machine capable of supplying sixty sixteen candle power lamps must be run for twenty-one hours to charge a sufficient number of cells of the Faure accumulator to operate the same number of lamps for twelve hours, thus showing a loss of energy developed in light of about forty-three per cent. by the use of the accumulator—this without taking into account the first cost and maintenance of the storage batteries. These figures are based upon the most economical method of charging the accumulators, which involves the fact that the time required to charge them must always greatly

exceed the time for which they are to be used in lighting. These are the economies; but there are, nevertheless, many uses for the accumulator in places where steam engines cannot be conveniently used, and where the cost per light is a matter of perfect indifference.

C. GODDARD,

Secretary Edison Electric Light Company."

THREE MORE STEAMSHIP PLANTS. The following additional orders for steamship plants have just been received:

(1). A plant consisting of two K and one L dynamos and 802 A lamps has been ordered for the steamer Pilgrim, of the Fall River line.

(2). A plant consisting of one Z dynamo and 130 B lamps has been ordered for the steamer Albatross, United States Fish Commission.

(3). The Bay Line Company, Baltimore, have ordered a plant of one Z dynamo and 120 B lamps for the Steamer Virginia, running from Baltimore to Norfolk. Our plant already in use on the steamer Carolina, which also runs from Baltimore to Norfolk, has given such satisfaction that the owners have decided to introduce the light also on the steamer Virginia.

BALTIMORE SUN. ANOTHER NEWSPAPER LIGHTED. We have received an order from Messrs. A. S. Abell & Co., Baltimore, for a plant of one L dynamo and 150 A lamps to light the offices and composing rooms of the *Sun*.

PIANO FACTORY PLANT. We have received an order from Messrs. William Knabe & Co. for a plant of one Z dynamo and 60 lamps, for their piano factory at Baltimore, Maryland.

LEHIGH VALLEY CAR SHOP PLANT. A plant of one L dynamo, 150 A lamps, has been ordered for the car shops of the

Lehigh Valley Railroad Company, Sayre, Penn.

DANGER FROM ELECTRIC WIRES. OURS ARE SAFE. In view of the discussion now going on in the local newspapers about the danger from electric light wires, it is well to bear in mind the difference between the Edison system and all others. All other dynamos than Mr. Edison's yield currents of very high potential or pressure, and hence the very greatest care is necessary in handling exposed portions of their circuits. Not a few fatal accidents have thus happened. With Mr. Edison's dynamo machine, even of the largest kind, such accidents are absolutely impossible. The reason for this is twofold: first, the electric pressure yielded by the machine is only 110 volts; and, secondly, owing to the fact that the resistance of the human body is very great (several thousand ohms), while the intensity of the Edison current is very small, only a small portion of the current in the Edison system, can traverse the body, even if the bare hands are placed on the principal mains. Accordingly, under no circumstances can a person by touching the Edison mains, get through him more than a small portion of a current of low potential; and there is for this reason absolute security to life. Mr. Edison's lights are everywhere run with this current of an intensity of only about 110 volts, whereas the arc lights require a current of about 20 times greater intensity, reaching in some cases to 2,400 volts. The difference between handling our conductors (charged with an intensity of 110 volts), and handling those of the arc lights (charged with 2,000 volts), is, to use a popular but inadequate illustration, about the same as between handling a metal of 110 degrees temperature, and one heated to 2,000 degrees. But the arc light wires not only burn, they also maim and kill. Mr. Edison early foresaw this danger arising from the use of currents of high potential, and perfected his system accordingly, using a current of very low intensity. Consequently the Edison conductors are safe.

SIX MORE FACTORIES TO BE LIGHTED. We have received the following orders for factory plants:

(1). The American Printing and Dye Works, Fall River, Mass., have ordered a plant consisting of one K dynamo and 250 A lamps.

(2). The Alberton Cotton Mills, Elysville, Maryland, have given us an order for a plant to light their mills consisting of one K dynamo and 250 A lamps.

(3). We have received an order from the Amory Manufacturing Company, Manchester, N. H., for a plant consisting of one K dynamo and 250 A lamps to light their cotton mill.

(4). Messrs. G. P. Ide, Bruce & Co., Troy, N. Y., have ordered a plant of one L dynamo and 150 A lamps to light their shirt-collar and cuff factory.

(5). We have received an order from the Matteawan Manufacturing Company, Matteawan, N. Y., for a plant consisting of one Z dynamo and 120 B lamps, to be used in lighting their hat factory.

(6). Messrs. D. Goff & Sons, manufacturers of braid at Pawtucket, R. I., have ordered a plant consisting of one Z dynamo and 60 A lamps for their factory.

TESTIMONIAL FROM BEATTY'S ORGAN FACTORY. We have received from Mr. Daniel F. Beatty the following testimonial:

"BEATTY'S ORGANS & PIANOS.
Office of DANIEL F. BEATTY.

WASHINGTON, N. J., Sept. 13th, 1882.

THE EDISON ELECTRIC LIGHT COMPANY,
65 Fifth Ave., New York.

Gentlemen—I have used your light in my factory with great satisfaction since the installation of the plant last January. Up to the present time we have had no trouble with it whatever, the two dynamos running without a hitch for many hours at a time, and supplying 300 lamps with a brilliant light. I am aware that 300 is above the number authorized by you, but the result has been very satisfactory thus far and as no undue heating of the machines has resulted or the life of the lamps shortened we are satisfied to run them along with this extraordinary result. The light is a marvel and I regard it as

the only illuminating agent suitable for large mills. My factory has an area of 184,000 square feet and to illuminate with gas manufactured on the premises or kerosene would be out of the question. The number of arc lamps that would be required would also be so expensive and require so large a dynamo as to practically put it out of reach. The power required by the Edison dynamos is very little. I am seriously contemplating doubling my plant and lighting the street extending from my factory to the Beatty building which is situated about one half a mile away. Of course I should illuminate my offices. I should like a man sent to make an estimate upon this scheme without delay.

I trust that you will achieve great success in all directions.

Very truly yours,

DANIEL F. BEATTY."

NEW YORK HERALD PLANT. This plant was started September 4th, and has been used nightly since. The average number of lamps burned all at once is 385, except Saturday nights when it is 460. The largest average number of lamps are used between midnight and 2 A. M., when the paper is being made up for press. The total number of lamps in the plant are 692, arranged as follows: press room 98, folding room 41, stereotype room 40, machine shop 9, Telegram office 7, counting room 51, library 60, office and private rooms 17, editorial rooms and office 47, Telegram composing and editorial rooms and Herald city editor's rooms 86, Herald composing rooms 196, sundry halls, closets, &c., 18, reflector used for lighting large news bulletin outside ("A" lamps of 32 C. P.) 13. There are also 9 lamps in the engine and boiler rooms in the Bennett Building. The boiler, engine and dynamos are located in the basement of the Bennett Building, corner of Ann and Nassau streets, the current being conducted to the Herald Building through 400 feet of Edison tubing, of which 350 feet is laid underground through Ann street. The boiler, made by Babcock & Wilcox, has a nominal capacity of 125 H. P.; the engine, made by Armington & Sims, and capable of developing 125 H. P., should the plant be hereafter increased, is now running at an average speed of 250 revolutions a minute, and the two Edison K dynamos, each with a capacity of 250

A lamps, have the usual electro-motive force of 110 volts. There is sufficient engine and boiler capacity to admit of doubling the number of lamps, should it be desired to do so at any future time. The boiler is located in a separate room from the engine and dynamos, the power being transmitted from the engine by means of belting, a line shaft and countershafts; and either dynamo can be put in or out of use by means of tight and loose pulleys on countershafts, the dynamos being also connected in multiple arc to the conducting lines, so that either one can be instantly thrown out. The lamps to light the large revolving bulletin used on the front portico of the Herald Building, displace an arc light and a special engine and dynamo formerly used for the purpose; and are found to be just what was wanted, far superior to the former method of lighting.

ANOTHER PLANT DOUBLED. The successors of Messrs. Seymour, Sabin & Co., (The North Western Manufacturing and Car Co.) have ordered their plant, mentioned in the Second Bulletin, to be doubled. "They have been trying," Mr. G. H. Bliss writes from Chicago, "some arc lights in a portion of their works without satisfaction, and have concluded to increase their incandescent rather than their arc light plant."

CINCINNATI. TANNERY LIGHTED. We have received an order from the American Oak Leather Company, Cincinnati, for a plant of one L dynamo and 150 A lamps.

BOSTON. DRY GOODS STORE PLANT. A plant of one L dynamo, and 162 A lamps, is being installed in the retail dry goods store of Messrs. Jordan, Marsh & Co., and will probably be started next week, at the time of their Autumn "opening."

EDISON'S UNITED STATES PATENTS. In the Sixth Bulletin we gave a list of patents relating to Electric Light issued in this

country to Mr. Edison up to the end of the year 1881. Since that time 63 additional patents on the same subject have been issued to him; eighteen on August 22d, one on September 5th, thirty-one on September 19th, one on October 3d, and 12 on October 10th, 1882. It is an interesting fact to note that the above issue of 31 patents is the largest number ever issued to one man at one time and on one subject in the whole history of patent law. We give below a list of these 63 patents. We also add 4 others for details of manufacture, &c., which have been granted to employees, and which have been assigned by them to us. All these patents, together with those mentioned in the Sixth Bulletin, and one which was then inadvertently omitted, make a total of 149 United States patents already issued and belonging to this Company; besides applications for 135 additional patents now pending in the Patent Office.

NUMBER.	DATE.	TITLE OF PATENT.
248,565	October 18, 1881.	Webermeter.*
263,133	August 22, 1882.	Dynamo or magneto-electric machine.
263,134	" 22, "	Regulator for dynamo or magneto-electric machines.
263,135	" 22, "	Electric lamp.
263,136	" 22, "	Regulator for dynamo or magneto-electric machines.
263,137	" 22, "	Electric chandelier.
263,138	" 22, "	Electric arc light.
263,139	" 22, "	Manufacture of carbons for electric lamps.
263,140	" 22, "	Dynamo-electric machine.
263,141	" 22, "	Straightening carbons of electric incandescent lamps.
263,142	" 22, "	Electrical distribution system.
263,143	" 22, "	Magneto or dynamo-electric machine.
263,144	" 22, "	Mold for carbonizing incandescents.
263,145	" 22, "	Making incandescents.
263,146	" 22, "	Dynamo or magneto-electric machines.
263,147	" 22, "	Vacuum apparatus.
263,148	" 22, "	Dynamo or magneto-electric machine.

*This was inadvertently omitted from list in Sixth Bulletin.

NUMBER.	DATE.	TITLE OF PATENT.
263,149	August 22, 1882.	Commutator for dynamo or magneto-electric machines.
263,150	" 22, "	Magneto or dynamo-electric machine.
263,878	Sept. 5, "	Electric lamps.
264,642	" 19, "	Electric distribution and translation system.
264,643	" 19, "	Magneto-electric machine.
264,645	" 19, "	System of conductors for the distribution of electricity.
264,646	" 19, "	Dynamo or magneto-electric machine.
264,647	" 19, "	Dynamo or magneto-electric machine.
264,648	" 19, "	Dynamo or magneto-electric machine.
264,649	" 19, "	Dynamo or magneto-electric machine.
264,650	" 19, "	Manufacture of incandescing electric lamps.
264,651	" 19, "	Incandescent electric lamp.
264,652	" 19, "	Incandescent electric lamp.
264,653	" 19, "	Incandescent electric lamp.
264,654	" 19, "	Incandescent electric lamp.
264,655	" 19, "	Incandescent electric lamp.
264,656	" 19, "	Incandescing electric lamp.
264,657	" 19, "	Incandescent electric lamp.
264,658	" 19, "	Regulator for dynamo- electric machines.
264,659	" 19, "	Regulator for dynamo-electric machines.
264,660	" 19, "	Regulator for dynamo-electric machines.
264,661	" 19, "	Regulator for dynamo-electric machines.
264,662	" 19, "	Regulator for dynamo-electric machines.
264,663	" 19, "	Regulator for dynamo-electric machines.
264,664	" 19, "	Regulator for dynamo-electric machines.
264,665	" 19, "	Regulator for dynamo-electric machines.
264,666	" 19, "	Regulator for dynamo-electric machines.
264,667	" 19, "	Regulator for dynamo-electric machines.
264,668	" 19, "	Regulator for dynamo-electric machines.
264,669	" 19, "	Regulator for dynamo-electric machines.
264,670	" 19, "	Regulator for dynamo-electric machines.
264,671	" 19, "	Regulator for dynamo-electric machines.
264,672	" 19, "	Regulator for dynamo-electric machines.
264,673	" 19, "	Regulator for dynamo-electric machines.
264,698	" 19, "	Electric lamp.
264,737	" 19, "	Incandescing electric lamp.
265,311	Oct. 3, "	Electric lamps and holders for same.
265,774	" 10, "	Maintaining temperature in webermeters.
265,775	" 10, "	Electric arc light.

NUMBER.	DATE.	TITLE OF PATENT.
265,776	October 10, 1882.	Electric lighting system.
265,777	" 10, "	Treating carbons for electric lamps.
265,779	" 10, "	Regulator for dynamo-electric machines.
265,780	" 10, "	Regulator for dynamo-electric machines.
265,781	" 10, "	Regulator for dynamo-electric machines.
265,782	" 10, "	Regulator for dynamo-electric machines.
265,783	" 10, "	Regulator for dynamo-electric machines.
265,784	" 10, "	Regulator for dynamo-electric machines.
265,785	" 10, "	Regulator for dynamo-electric machines.
265,786	" 10, "	Dynamo-electric machine.
		Apparatus for the electrical transmission of power.
265,858	" 10, "	Regulator for dynamo-electric machines.
265,859	" 10, "	Regulator for dynamo-electric machines.

BESANCON, FRANCE. WATER POWER USED. The Edison Company at Besancon, have had an experimental plant of 3 Z dynamos in successful operation since September 1st. The dynamos are run by a water-power situated at a distance of 1,300 metres from the places lighted up, and the current is sent through 1,100 metres of cable. These dynamos supply light for a tunnel through the rocks, in which 37 A lamps are used, also to light a street, several private houses and stores, among which are the Café Granville with 35 A lamps, and the Maison Dubois with 27 A lamps. This plant is installed with a view to the ultimate establishment of a Central Station, from which the whole town will be supplied with the Edison light; and a peculiar interest attaches to the plant from the fact of the use of hydraulic power situated nearly a mile from the scene of lighting.

THE CHICAGO COMPANY START A BULLETIN. The Western Edison Light Company, Chicago, have started a Bulletin. The first number was issued September 12th. It is a small pamphlet modelled after this Bulletin, and is published for the information of

the stockholders in the Chicago Company. Stockholders in any of our Companies can doubtless obtain copies by writing to the office of the Western company, Nos. 51 and 53 Wabash Avenue, Chicago.

LORRAINE MILL PLANT. In this plant the arc lights will not be displaced, but will continue to be used in the old mill, while our light will be used in the new, so as to enable the proprietors to determine which is the better adapted for their business.

PERPIGNAN, FRANCE. LARGE PAPER FACTORY LIGHTED. A plant of 1 Z dynamo with 50 A and 28 B lamps is being installed in the paper factory of Messrs. Bardou et Fils.

ST. CHAMAS, FRANCE. The Government powder manufactory is now lighted with an Edison plant. This installation has some special features. The wires are all outside the building and all lamps are in recesses in the walls, with a pane of glass in front, between the lamp and the interior. The officials have expressed themselves as being well satisfied, and it is probable that an Edison plant will also be installed in the arsenal.

AN ORGAN FACTORY PLANT. The Bridgeport Organ Company, Bridgeport, Conn., have ordered a plant consisting of one K dynamo and 500 B lamps for use in their factory.

BUENOS AYRES. An Edison plant was started August 25th, in the Confiteria del Gas, and has been running ever since with success. The light is used four hours every night, and the local newspapers are enthusiastic in praise of it.

A FLOUR MILL TO BE LIGHTED. Messrs. George Urban & Co., Buffolo, N. Y., have ordered a plant consisting of one E dynamo and 15 A lamps for their flour mill.

BOSTON. OUR EXHIBIT AT THE INSTITUTE FAIR.

The exhibition of the Edison light announced in the last Bulletin to be made at the Manufacturers and Mechanics Institute Fair, is in operation. The installation and management of the plant has been under the charge of Mr. Spencer Borden, Manager of the New England Department of the Edison Company, who succeeded on short notice in having everything in readiness, so that when Mr. Edward Atkinson commenced his address at the opening of the Fair, on the morning of September 6th, the entire Edison exhibit was started, although it was daylight. Since then it has run continously with marked success. The plant consists of two K dynamos, driven from a countershaft by a Lawrence 12½ x 20 engine, and two dynamos, an L and a Z, driven directly from an 8½ x 10 engine of the same make. The disposition of the lamps is as follows: lamps of 32 candle power each: show case of Pacific Mills, 14 lamps, entrance to exhibition 12 lamps, arches entering restaurant 5 lamps, total 31: lamps of 16 candle power each: Edison exhibit 9 lamps, toilet room, 19 lamps, press room 11 lamps, money office 4 lamps, restaurant 77 lamps, grocer and druggist's exhibit 184 lamps, textile machinery 137 lamps, western art gallery 129 lamps, black and white art gallery 48 lamps, Home Sewing Machine Co. 7 lamps, D. P. Illsley, hatter, 5 lamps, aggregating 630 sixteen candle-power lamps. Total, with some other miscellaneous lights, 694 lamps.

The dynamos are under the immediate charge of Mr. A. F. Moore. All four are connected into a single resistance box in their magnet circuit, each does its allotted task, and the current of all four is collected into a single circuit, being conveyed to distant parts of the building through feeders of the Edison Electric Tube Company. The current for the Edison space is measured through a meter such as is used in the First District in New York City, and no single feature of the system attracts more attention than this.

In the West Art Gallery the light shows to its best advantage. This gallery was designed by the same architect under whose supervision the gallery of the Boston Art Club was built, and is of the same dimensions. At the Art Club light is furnished by 375 gas burners, while the West Art Gallery, at the Institute Fair, is lighted quite as well, in the opinion of competent judges, by 129 Edison A lamps. This illumination is so pleasing to the managers of the Fair, that the company lighting the East Art Gallery with arc lights, will withdraw the same, and the Edison Company have been asked to place their lights there, as in the other. This installation is now going forward, an additional L machine being used for the purpose, furnishing current for the Art Gallery, as well as for one or two exhibitors who have asked to have their spaces lighted, through an independent main.

The unique display of the 7 lamps in the exhibit of the Home Sewing Machine Company attracts much attention. Each lamp is suspended from the ceiling by a flexible hanging support consisting of a piece of canvass tape three inches wide covered with blue satin. The wires run from the ceiling through the tape to the lamp, which is suspended at the lower end, and these flexible hangers are covered with artificial vines and flowers. In lighting the textile machinery, Mr. Paine arranged his lamps not so as to make an advertisement by a great glare of light, but in exactly the manner that experience had indicated was sufficient for lighting the same machines in actual mill work. There is thus no false impression given, and persons who buy apparatus for mill lighting on the strength of what they see at this Exhibition, will not be disappointed when they see the light in they own factories.

Mr. C. D. Stickney, one of Mr. Borden's assistants in the Edison New England Department, has the exhibition under his care every evening, and with such others of the departmental corps as can

make it possible to attend, explains the system to the hundreds who find the Edison light the chief attraction of the Fair. Nor are the visitors mere sight-seers. A large number of manufacturers have here become acquainted with the system for the first time, and many have notified the Department of their intention of visiting the Fair to investigate the details of the Edison light, and examine its practical workings.

ANOTHER PLANT ENLARGED. Messrs. Weed, Parsons & Co., Albany, N. Y., who have been using a plant of 120 B lamps in their printing house, as mentioned in the Tenth Bulletin, have given us an order for a K dynamo, which will increase their plant four-fold.

ERIE GRAIN ELEVATOR PLANT. A plant of one L dynamo and 202 A and B lamps is being installed in the Erie Grain Elevator, Jersey City, N. J. This elevator is owned by Messrs. Hazeltine & Annan and has a capacity of 1,500,000 bushels.

MUNICH, BAVARIA. THEATRE LIGHTED. The lighting of the theatre in connection with the Munich Exposition, was finally awarded to the Edison Company, as stated in the last Bulletin. The plant has been installed and the light has now been in us three weeks, illuminating the theatre daily. This exhibit is receiving approval as being exceptionally successful in theatre lighting.

LENNI, PA. ANOTHER FACTORY PLANT. The Park Mount Cotton and Woolen Company, Limited, Lenni, Pennsylvania, have ordered a plant consisting of one Z dynamo and sixty A lamps.

LIST OF EDISON PLANTS INSTALLED IN THE UNITED STATES. There are 123 Edison isolated plants, aggregating 21,998 lamps, now running or in process of installation in various parts of the United States. Below is a list showing the names and addresses of the purchasers, and their business.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Oregon Railway & Navigation Co.	Portland, Oregon	Steamship "Columbia"	120
Hinds, Ketcham & Co.	New York City	Printers	240
New York & Norwich Line	N. Y. & New London	S. S. "City of Worcester"	325
Prospect House	Blue Mountain Lake	Hotel	125
Baldwin Locomotive Works	Philadelphia	Machine Shops	75
James Harrison	Newburgh, N. Y.	Woolen Mill	126
Nathan & Dreyfus	New York City	Machine Shops	145
United States Rolling Stock Co.	Chicago, Illinois	Car Shops	126
United States Rolling Stock Co.	Urbana, Ohio	Car Shops	125
Manhattan Railway Co.	New York City	Car Shops	125
McKee & Fuller	Catasauqua, Pa.	Car Shops	120
Seymour, Sabin & Co.	Stillwater, Minn.	Car Shops	250
Danforth Locomotive Works	Paterson, N. J.	Locomotive Works	60
Oregon Railway & Navigation Co.	Portland, Oregon	Steamship Docks	120
Oregon Railway & Navigation Co.	Portland, Oregon	S. S. "Queen of Pacific"	250
James Gordon Bennett	Yacht "Namouna"	Steam Yacht	120
James Gordon Bennett	New York City	*Herald* Building	[illegible]
George W. Childs	Philadelphia, Pa.	*Ledger* Building	250
Winona Mills	Winona, Minn.	Flour Mills	70
James Taylor	Newburgh, N. Y.	Cloth Mill	125
Tingue, House & Co.	Glenville, Conn.	Cloth Mill	130
W. Strange & Co.	Paterson, N. J.	Silk Mill	65
Clark Thread Co.	Newark, N. J.	Thread Works	125
Merrimack Manufacturing Co.	Lowell, Mass.	Print Works	250
Fall River Bleachery	Fall River, Mass.	Bleachery	145
Merrick Thread Co.	Holyoke, Mass.	Thread Works	98
Wamsutta Mills	New Bedford, Mass.	Cotton Mill	750
Alfred Dolge	Dolgeville, N. Y.	Piano Materials	126
E. S. Jaffray & Co.	New York City	Dry Goods	180
H. K. & F. B. Thurber & Co.	Moorestown, N. J.	Canning Factory	60
H. K. & F. B. Thurber & Co.	New York City	Wholesale Groceries	330
Sperry & Barnes	New Haven, Conn.	Meat Packers	240
Carr & Hobson	Bergen Point, N. J.	Agricultural Implements	120
D. F. Beatty	Washington, N. J.	Organs and Pianos	250
J. B. Stetson & Co.	Philadelphia	Hat Factory	120
American Bank Note Co.	New York City	Engraving	125
Boston Sugar Refinery	East Boston, Mass.	Sugar Refinery	125
Brooklyn Sugar Refinery	Brooklyn, L. I.	Sugar Refinery	80
Ohio State Journal	Columbus, O.	Newspaper	60
J. O. Mattheissen & Wiechers	Jersey City	Sugar Refinery	300
J. Pierpont Morgan	New York City	Residence	300

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
J. Hood Wright	Fort Washington	Residence	240
Hotel Everett	84 Chatham St. N. Y.	Hotel	130
Borden Block	Fall River, Mass	Offices, Stores, &c	137
Record Room	Washington, D. C.	Gov't Printing Office	125
National Tube Works	McKeesport, Penn.	Tubing	65
R. H. Coleman	Cornwall, Penn.	Smelting	60
Rittenhouse Manufucturing Co.	Passaic, N. J.	Woolen Mill	65
Arlington Mills	Lawrence, Mass.	Cotton and Woolen Mill	130
Professor Henry Draper	New York City	Laboratory	15
Spencer, Trask & Co.	Albany, N. Y.	Bankers	15
E. & T. Fairbanks & Co.	St. Johnsbury, Vt.	Scales	60
Weed, Parsons & Co.	Albany, N. Y.	Printers	450
J. P. Squires & Co.	E. Cambridge, Mass.	Pork Packers	130
Trenton Iron Works	Trenton, N. J.	Iron	75
King Phillip Mills	Fall River	Cotton Mill	750
Max Ams	New York City	Canning Factory	65
Hotel Vendome	Boston	Hotel	63
Western Edison Light Co.	Chicago, Illinois	Agency	250
J. W. Doane, Marshall Field, Edson Keith, O. R. Keith	Chicago, Illinois	Residences	250
Calumet Club	Chicago, Illinois	Club House	64
N. K. Fairbanks	Chicago, Illinois	Residence	65
Academy of Music	Chicago, Illinois	Theatre	125
H. J. Rogers	Appleton, Wisconsin	Mills	500
State Prison	Anamosa, Iowa	Prison	216
Gazette Publishing Co.	Davenport Iowa	Davenport *Gazette*	120
Rand, McNally & Co.	Chicago, Illinois	Publishers	130
Marshall Field & Co.	Chicago, Illinois	Dry goods	65
Palmer House	Chicago, Illinois	Hotel	84
National Life Insurance Building	Chicago, Illinois	Insurance	130
McCormick Machine Co.	Chicago, Illinois	Harvesters, &c	130
Worumbo Mills	Lisbon Falls, Me.	Woolen Mill	150
Bourne Mills	Fall River	Cotton Mill	540
Record Building	Philadelphia	Newspaper	250
Laurel Lake Mills	Fall River	Cotton Mill	400
Slater Cotton Co.	Pawtucket, R. I.	Cotton Mill	300
Pemberton Mills	Lawrence, Mass.	Cotton Mill	375
Lockwood Co.	Waterville, Me.	Cotton Mill	250
Germania Mills	Holyoke, Mass.	Woolen Mill	70
New England Pin Co.	Winsted, Conn.	Silk Mill	250
Aitken, Son & Co.	New York City.	Dry Goods	120
Pottstown Iron Co.	Pottstown, Penn.	Iron	60
Conanicut Mills	Fall River	Cotton Mill	250
Peacedale Manufacturing Co.	Peacedale, R. I.	Woolen Mill	250
Everett's Hotel	102 Vesey St. N. Y.	Hotel	250
R. M Pulsifer & Co.	Boston	Boston *Herald*	150
Baltimore Steam Packet Co.	Baltimore, Md.	Steamer "Carolina"	126

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Harder Knitting Co.	Hudson, N. Y.	Knitting Mill	160
Eastman Dry Plate Co.	Rochester, N. Y.	Photographic Materials	15
Sibley Manufacturing Co.	Augusta, Ga.	Cotton Mill	450
Mill Creek Distilling Co.	Cincinnati, Ohio	Distillery	60
Lorraine Woolen Co.	Pawtucket, R. I.	Woolen Mill	400
Willimantic Linen Co.	Willimantic, Conn.	Linen Thread	60
Boston Rubber Shoe Co.	Malden, Mass.	Rubber Shoes	60
Sayles & Washburn	Mechanicsville, Con.	Woolen Mill	132
Whiting Paper Co.	Holyoke, Mass.	Paper Mill	120
Ladd & Logan	San Francisco, Cal.	Agency	60
University of Missouri	Columbia, Mo.	College	65
Prof. C. A. Young	Princeton, N. J.	College	30
O. N. Taylor	Ludington, Mich.	Saw Mill	15
Fall River Line	Fall River & N. Y.	Steamer "Pilgrim"	802
American Printing & Dye Works.	Fall River, Mass.	Printing and Dying.	250
Amory Manufacturing Co.	Manchester, N. H.	Cotton Mill	250
U. S. Fish Commission	Washington D. C.	Steamer "Albatross"	130
G. P. Ide Bruce & Co.	Troy, N. Y.	Collar and Cuff Factory	150
Alberton Cotton Mills	Elysville, Md.	Cotton Mill	250
Bridgeport Organ Co	Bridgeport, Conn.	Organ Factory	500
A. S. Abell & Co.	Baltimore, Md	*The Sun*	150
Matteawan Manufacturing Co.	Matteawan, N. Y.	Hat Factory	120
George Urban & Co.	Buffalo, N. Y.	Flour Mill	15
D. Goff & Sons	Pawtucket, R. I.	Braid Mill	60
William Knabe & Co.	Baltimore, Md.	Piano Factory	60
Baltimore Steam Packet Co.	Baltimore, Md.	Steamer "Virginia"	120
C. W. & E. Pardridge & Co.	Chicago, Ills	Dry Goods Stores	310
H. D. Smith	Appleton, Wis	Residences, Factories, &c.	250
Norton Brother & Co.	Chicago, Ills.	Flour Mill	15
Best Brewing Co.	Milwaukee, Wis.	Empire Brewery	506
Butters, Peters & Co.	Tallman, Mich.	Saw Mill	60
Jordan, Marsh & Co.	Boston, Mass.	Dry Goods	102
American Oak Leather Co.	Cincinnati, Ohio.	Tannery	150
Erie Grain Elevator	Jersey City, N. J.	Elevator	202
Lehigh Valley, R. R. Co.	Sayre, Pa.	Car Shops	150
Park Mount Cotton & Woolen Co., Limited,	Lenni, Pa.	Cottons and Woolens	60
		TOTAL,	21,998

THE CENTRAL STATION DYNAMO. The *Engineering*, London, some time ago published a lengthy article on the Edison System, in which is the following elaborate description of the Edison Central Station Dynamo, now running at the Holborn Viaduct, London, and at the Pearl Street Station, First District, New York City:

"This generator is of the Edison horizontal type, the magnetic field being produced by a battery of twelve horizontal electro-magnets disposed in three rows of four magnets each, two rows being attached by their ends to the upper pole-piece, and one row to the lower pole-piece, the further ends of all being united by a massive heel plate, seen at the back of the figure. The armature is driven at a speed of 350 revolutions per minute, within a cylindrical space bored out of the very massive pole-pieces shown in the front of the illustration, and which are built up of twelve heavy blocks of cast iron held together by long bolts threaded through them, and by surface coupling plates screwed on to three of their faces. The armature, like that of the Paris machine, is of cylindrical form, and is composed, first of a core built up of no less than 2200 discs of very thin sheet iron, alternating with discs of tissue paper, while at every foot measured in the direction of its length, is a disc of thick iron to give stability and rigidity to the armature; the whole is squeezed and bolted together by eight longitudinal bolts passing through all the discs, and through a pair of endplates by which the pressure is applied, and the whole is bushed with a tube of wood, so as to insulate the armature core from the rest of the machine. The induction portion of the armature is composed of 108 straight longitudinal thick bars of nearly pure copper of trapezoidal cross-section, arranged at equal distances around the core and insulated from it. These 108 copper bars are united at alternate ends to as many copper discs, half of which number are strung on to the shaft at one end of the armature and the other half at the other; all the discs are insulated from the shaft and from one another, and the bars are so connected with them that the bars and discs together form a continuous and closed circuit, wound as it were longitudinally around the core. This coupling up is effected as follows: each of the copper bars is connected at each end to the edge of one of the copper discs, and the diametrically opposite edge of the same disc is connected to the corresponding bar at the opposite side of the armature; this bar in its turn is connected to one of the discs at the other end, and the opposite edge of this disc is connected to the bar next in rotation to the bar we started with, this again to the next disc at the other end, until all the bars and all the discs have been connected together in such a way that a current of electricity transmitted through the armature would pass along one bar, then across the disc at one end, back by the corresponding bar on the opposite side, then across a disc at the other end to the second bar, along that to No. 2 disc and back on the opposite side to another disc, so that for all electrical purposes the bars and discs together may be looked upon as making up a thick copper coil of extremely low resistance, wound longitudinally over an iron cylinder in a single layer, the various convolutions of which being at equal angular distances apart around the circumference of the cylinder.

In the disposition of the inductive portion of this armature it is identical with the armature of the ordinary Siemens direct-current machine, but the coupling up is simpler, and the course taken by the currents produced is in consequence somewhat different.

The diameter of the armature when complete is 28 in., its length is 5 feet, and its weight is over four tons. When it is remembered that this mass is revolved within the hollow cylindrical space between the pole-pieces at a speed of 350 revolutions per minute, it will readily be anticipated that if the heavy bars of copper were attached to the armature only at their ends, which are between 4 ft. and 5 ft. apart, and revolving as they do at a circumferential speed of 43 ft. per second, the armature would be speedily destroyed by the bars flying out under the influence of centrifugal force, and coming in contact with the iron pole-pieces which embrace them. To prevent this, the bars are held together at short distances along the length of the armature by coils of steel piano-forte wire bound tightly round the bars over bands of mica, by which they are insulated from them, and some idea may be formed of the high class workmanship and fitting together of this finely constructed machine when we state that although the diameter of the revolving armature is 28 in., that of the cylindrical space within which it revolves is only 28¼ in., thus allowing but one-eighth of an inch clearance between the induction bars and the pole-pieces. It is needless, of course, to point out that this accuracy of construction adds very considerably to the efficiency of the machine, by enabling the armature to revolve in a more intense magnetic field than if, through less accurate workmanship, the magnetic poles, to insure the safety of the machine, had to be farther off.

The electro-magnets by which the magnetic field is produced, consist of twelve horizontal cylindrical bars of iron about 8 ft. long, and coiled throughout their whole length with thick insulated copper wire. The coils of these magnets are connected together in two parallel circuits of six coils each, and the resistance of the circuit so arranged, and which form a derived or shunt circuit to that of the machine, is 21 ohms. The resistance of the armature, as will be apparent from a consideration of its construction is practically inconsiderable, measuring only about $\frac{5}{10800}$ of an ohm (.00049 ohm).

The commutator is a cylinder built up of a number of insulated copper sections as in that of the Siemens and Gramme machines, there being as many copper segments as there are induction bars on the armature, and are connected to them by as many radial copper rods attached in such a manner that owing to a slight elasticity at the junction there is no tendency for them to be sheared off in the starting and stopping of the machine, a defect which showed itself in the machines of this type which were first constructed. Upon the cylindrical surface of this commutator are pressed two sets of metallic brushes or collectors mounted in spring fittings attached to a rocking arm—shown to the extreme right of the illustration—by which the angular position of the points at which the brushes make contact with the commutator can be adjusted with respect to the neutral plane of the magnetic field so as to obtain the maximum efficiency of the machine.

The motive power is a horizontal engine of the Porter type, of 130 horse power nominal, fitted with a Porter governor and expansion gear, and with a

steam pressure of 120 lb.; it drives the armature which is mounted on the crank-shaft at a velocity of 350 revolutions per minute, the steam being supplied by one of Messrs. Babcock and Wilcox's compound tubular boilers. The weight of the machine with its engine and bedplate, which is common to both, is over 30 tons.

In order to keep the armature cool, thereby protecting its insulation and keeping down its resistance, there is a small blowing fan driven by the engine, and from this blower three pipes are led which communicate with three air channels cut through the pole-pieces, so as to maintain three jets of air constantly impinging on the middle of the rotating armature, which, escaping right and left are, during the working of the machine, contimually bathing the induction bars with air. The efficiency of this arrangement is proved by the fact that streams of perceptibly warm air are, when the apparatus is in action, continually issuing from the two ends of the hollow cylindrical space within which the armature is rotating."

Following this description of the dynamo, are descriptions of the Edison lamp, conductors, fire protector, current regulator, electro-motive-force indicator and meter. The article then concludes with the following interesting prediction:

"Within the limits of a preliminary and introductory article, such as this is intended to be, it is impossible to do more than indicate the general features of a system consisting of so many points of interest, but we have in the present notice gone over sufficient ground to show that if the panic was premature which was produced in the gas-share market some three years ago by the announcement that Mr. Edison had elaborated a complete and practical system of electric lighting to compete successfully with gas on all its points, Mr. Edison has since made good his claim to the laurels he was thought to have lost by the natural collapse of an unreasonable scare, for, if the permanent working of the installation on the Holborn Viaduct prove as successful in its results as those of the experimental trials have—and there is no reason to suppose it will not—there can be little doubt that an era is opening for electric illumination greater in magnitude and importance than has ever preceded it. And we need hardly say we hope that such may prove to be the case."

No. 15.
DECEMBER 20, 1882.

FIFTEENTH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE, NEW YORK.

December 20th, 1882.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stock-holders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

CONTENTS.

FIRST DISTRICT, NEW YORK CITY. This plant has been in operation night and day without a moment's stop since it was started at 3 P. M., September 4th. There have been no obstacles except those of a purely mechanical nature relating to the imperfect regulation of the engines. This trouble was mentioned in the last Bulletin. Everything relating to the electrical apparatus, as regards both the plant at the central station and the underground conductors, has exceeded our anticipations, and if any doubts ever existed touching the ultimate success of the system, they are now dispelled.

At the date of the last Bulletin, October 14th, we were lighting 85 houses. Since then we have made additional connections, and are now lighting 225 houses, wired for about 5,000 lamps. All of these buildings have been inspected by the Board of Fire Underwriters, and certificates authorizing the use of our light have been issued in every case. Additional houses are still being connected.

It is a singular fact that statements to the effect that the plant in the First District has proved a failure are still published. The most conspicuous of these statements, printed in the American *Gas Light Journal*, October 2d, was copied in the last Bulletin, and a detailed and explicit denial was there given by us to every part of the statement. It was that our First District was a "complete failure" because "the electricity was conveyed away owing to imperfect insulation." This allegation betrayed such an utter lack of knowledge touching electrical subjects, it was surprising that a reputable journal published it, and we ventured to hope that in future the newspapers would be more careful. Such, however, has not proved to be the case. Recently another anonymous communication, betraying an equally astounding lack of knowledge touching electrical matters and an equally complete perversion of facts, has been published in the editorial page of one of our daily papers. We refer to the following letter printed in the New York *Sun*, November 29th:

"To the Editor of The Sun:

Sir:—In reading the discussions relative to the Pearl street station of the Edison light, I have noted that while it is claimed that there is scarcely any loss from leakage of current, nothing is said about the loss due to the resistance of the long circuits. I am informed that this is the secret of the failure to produce with the power in position a sufficient amount of current to run all the lamps that have been put up, and that while six, and even seven, lights to the horse power may be produced from an isolated plant, the resistance of the long underground wires reduces this result in the above case to less than three lights to the horse power, thus making the cost of production greatly in excess of gas. Can the Edison Company explain this?

Investigator."

To the foregoing letter of "Investigator," the President of our Company made the following reply, which appeared in the *Sun* of December 3d.:

"To the Editor of The Sun:

Sir:—"Investigator" in Wednesday's *Sun*, says that the Edison Company is troubled at its Pearl street station with "a loss of current, due to the resistance of the long circuits;" also that whereas Edison gets "six, or even seven lights to the horse-power in isolated plants, the resistance of the long underground wires reduces that result in the Pearl street station to less than three lights to the horse-power." Both of these statements are false. As regards loss due to resistance, there is a well-known law for determining it, based on Ohm's law. By use of that law we knew in advance, that is to say, when the original plans for the station were drawn, just what this loss would be, precisely the same as a mechanical engineer when constructing a mill with long lines of shafting can forecast the loss of power due to friction. The practical result in the Pearl street station has fully demonstrated the correctness of our estimate thus made in advance. As regards our getting only three lights per horse-power, our station has now been running three months, without stopping a moment, day or night, and we invariably get over six lamps per horse-power, or substantially the same as we do in our isolated plants. We are now lighting 193 buildings, wired for 4,400 lamps, of which about two-thirds are in constant use, and we are adding additional houses and lamps daily. These figures can be verified at the office of the Board of Underwriters, where certificates with full details permitting the use of our light are filed by their own inspector. To light these lamps we run from one to three dynamos, according to the lamps in use at any given time, and we shall start additional dynamos as fast as we can connect more buildings. Neither as regards the loss due to resistance, nor as regards the number of lamps per horse-power, is there the slightest trouble or disappointment on the part of our company, and your correspondent is entirely in error in assuming that there is. Let me suggest that if "Investigator" really wishes to investigate, and is competent and willing to learn the exact facts, he can do so at this office, where there is no mystery or concealment, but, on the contrary, a strong desire to communicate facts to intelligent inquirers. Such a method of investigating must certainly be more satisfactory to one honestly seeking knowledge than that of first assuming an error as the basis of a question and then demanding an explanation."

This denial disposes of the allegations made in the letter of "Investigator." Let us hope that we shall not be called upon again to answer such frivolous misrepresentations about our business.

MR. MORGAN'S RESIDENCE LIGHTED. The residence of Mr. J. Pierpont Morgan, at the corner of Madison Avenue and Thirty-sixth Street, New York City, is lighted throughout with an Edison isolated plant of 269 A and 116 B lamps. Gas has been abandoned with the exception of a few jets at various points for use when the electric light engines are not working. The different

lamp circuits throughout the house are protected by the usual Edison safety-guards against fire, while switches, each designed to control a large number of lamps, are conveniently arranged in the different rooms so that the lights are under perfect control, and can be turned on and off in quantity, in addition to each lamp being lighted or extinguished singly.

The residence has been wired throughout, and the Edison lamps are located about as follows:

Main halls and stairway	39
Attic rooms and halls	14
Dome over stairway	20
Servants halls and butler's pantry, closets, &c.	15
3d floor bed-rooms and dressing-rooms	20
2d floor bed-rooms and dressing-rooms	40
1st floor:	
Drawing room	42
Reception room	11
Library	10
Sitting-room	22
Dining-room	22
Stained glass skylight in dining-room ceiling	22
Conservatory	42
Basement	28
Cellar	28
Stable and carriage house	6
Engine-room	4
Total number of lamps	385

BOSTON. ANOTHER SUGAR REFINERY TO BE LIGHTED. We have received an order for a plant of one L dynamo and

150 A lamps, to be installed in the Bay State Sugar Refinery, Boston, Mass.

NEW ORLEANS. ST. CHARLES HOTEL TO BE LIGHTED. An order has been received from Col. R. E. Rivers, for a plant consisting of one L dynamo and 150 A lamps, to partially light the St. Charles Hotel, New Orleans, La.

TESTIMONIAL FROM THE OHIO STATE JOURNAL PLANT, COLUMBUS. The following testimonial has been received from the *Ohio State Journal*, Columbus, Ohio, lighted by an Edison isolated plant:

"In response to your inquiry I beg to say that we are using the Edison system of electric light, and find it in every respect exceedingly satisfactory. It is safe, cheap, easily managed, and gives us no more care than gas pipes and fixtures although we employ no electrician, in fact our engineer attends to the whole thing. Some reasonably accurate experiments looking to its relative cost of production develop the fact that it is about equal to gas at $1 per thousand. Our employees prefer it very much above gas.

Yours truly,
J. C. BRIGGS,
BUSINESS MANAGER."

AUGUSTA. ANOTHER PLANT INCREASED. We have received an order from the Sibley Manufacturing Company, Augusta, Georgia, for an L dynamo, thus increasing their lamp capacity to 650 lamps.

PAPER HANGING FACTORY LIGHTED. A plant of one Z dynamo and 60 A lamps has been ordered by Messrs. Whiting & Campbell, manufacturers of paper hangings, New York City.

NORTH CAROLINA. COTTON MILL PLANT. We have received an order for a plant consisting of one L dynamo and 100 A lamps for the cotton mill of Mr. R. Y. McAden, at Lowell, North Carolina.

HOLYOKE. ALBION PAPER MILL TO BE LIGHTED. We have received an order from the Albion Paper Company, Holyoke, Mass. for a plant of one L dynamo and 150 A lamps to be installed in their paper mill.

NORTH ADAMS. ARNOLD PRINT WORKS. We have received an order for a plant consisting of one L dynamo and 150 A lamps, to be installed in the Arnold Print Works, North Adams, Mass.

AKRON, OHIO. STRAW-BOARD FACTORY PLANT. A plant of one L dynamo and 130 A lamps has been ordered for the factory of the Portage Straw-Board Company, Akron, Ohio.

BIJOU THEATRE LIGHTED, BOSTON. An Edison plant consisting of about 650 lamps has been installed in the new Bijou Theatre, Boston, of which Messrs. Hastings & Tyler are proprietors. The opening night of the theatre, when our plant was started with great success, was on December 12th.

The station from which the theatre is lighted is located about 500 feet away in the basement of the printing office of Messrs. Cashman, Keating & Co., No. 603 Washington Street. In this station we have placed a Babcock & Wilcox boiler of 72 horse power, fed through two Korting injectors supplied with water from a one inch pipe put in by the Municipality of Boston. The power is supplied by a "Lawrence" engine, single disc pattern, with a cylinder 12½ inches in diameter, and 20 inch stroke. This engine was furnished by the Builders' Iron Foundry, Providence. The shafting, pulleys and hangers were supplied by the Whittier Machine Co.; and the belts by T. B. Adams & Co. The power is applied by means of a countershaft to two Edison K dynamos, which furnish the current for the lights, the electricity being conveyed to the theatre through about

500 feet of No. 2½ Edison Electric Tubes, similar to those laid in our First District in New York City. All the conductors are brought under the stage to a point at the right hand side of the proscenium arch, where all the regulating apparatus is placed, and where all the lights can be controlled by one man. Here also, are the three regulators for raising and lowering the intensity of the lights, one controlling those in the auditorium, another those on the flies, and the third controlling the lights on the proscenium arch. Here also, on a single board, are all the safety plugs and eleven switches, which control all the lights on the stage, and in the auditorium. Four other switches for the lights at the front entrances, foyer and offices, are on a board in the box office.

In the lighting of the stage a broad departure has been taken. There are no footlights whatever, the stage being lit by 192 A lamps placed in three rows on the surface of a concave tin reflector running around the back of the proscenium arch. Between the flies are similar tin reflectors, straight across the stage, in which are placed 140 A lamps. These latter fixtures can be raised and lowered by ropes and pulleys as may be desired for stage effects. In the auditorium, hanging from the centre of the dome, is a fine crystal chandelier of Moorish design, illuminated by 60 A lights, and at three other points from the dome hang smaller chandeliers of similar design, each with 18 A lamps. In the gallery and second tier of boxes are side lights with 44 lamps, and under the galleries 44 others. The staircases are lighted by three chandeliers having 12 lights each, and the foyer by one chandelier of 6 lights and two of 3 lights each. There are four chandeliers of 4 lamps each and one of 6 lamps in the offices, and at the front of the theatre is a lantern containing 40 A lamps. The total number of lamps is 644.

This installation, one of the largest and most complete ever made, was finished in two weeks from the receipt of the order.

THEATRE LIGHTED AT CHICAGO. TESTIMONIAL. Mr. Daniel Shelby, Proprietor and Manager of the Academy of Music. Chicago, furnishes the following testimonial about our light in use in his theatre:

"CHICAGO, Nov. 15th, 1882.

THE WESTERN EDISON LIGHT COMPANY:

GENTLEMEN—Being the first manager in the United States with nerve enough to try the experiment of lighting the auditorium of a theatre with the Edison Incandescent Light, it gives me great pleasure to certify to the satisfaction your system has given me. The light is steady, soft and pleasing to the eye, no flaring or glare, no dust or smoke, no heat. We can now dispense with the lighting up, as in gas, by the alcohol torch, thereby reducing the danger of fire in the building.

Another and most important item in favor of the light, is its comparatively insignificant cost, after the first arrangements are completed. During the winter months, while the house is heated with steam, the same boiler supplies the power for heat and the dynamo, making the expense of lighting positively nothing. During the warm weather the expense is only the engineer's salary and cost of coal.

The lights are under perfect control by a system of switches in the prompt-place, and can be turned on and off at will. I am using 160 burners in auditorium, lobbies and street lights—in fact, in all parts of the theatre except the border and footlights; and I find my lighting expenses reduced about $200 per month. I most cheerfully recommend the Edison Incandescent Light to my brother managers throughout the country, as I am fully convinced that it is the only system of electric lighting that will give perfect satisfaction to both the manager and his audience.

Respectfully yours,

DANIEL SHELBY."

THEATRE LIGHTED AT HAVANA, CUBA. The Albisu Theatre, Havana, is lighted by an Edison plant. Mr. A. Montamat, the agent in charge of the Edison light at Havana, has furnished the following particulars of the installation. The plant consists of two Z dynamos with 186 B lamps and 11 A lamps in the theatre, also about 20 lamps in the building where the dynamos and engine are placed. The arrangement of the lights in the theatre is as follows: Footlights, 22 B lamps, two borders of 10 B lamps each, two borders

of 6 B lamps each, 36 branches of two B lamps each attached to the pillars of the three galleries, four clusters of 4 B lamps each placed on either side of the drop near the first boxes, 24 B lamps distributed in the four passages 6 in each, 6 B lamps on the landings in front of the mirrors, 10 B lamps placed in several private boxes, 6 A lamps in the lobby and 5 A lamps on the outside, under the colonnade, making a total in the theatre of 186 B and 11 A lamps. The borders as well as the footlights have tin reflectors closed at the top, which allow all the light to be thrown on the stage, and this accounts for its being sufficiently lit, notwithstanding the comparatively small number of lamps used. Twilight and night effects are obtained by means of resistance boxes. The dynamos are driven by a 14 horse power steam engine in a building 120 feet distant from the theatre, the conductors being run overhead at a height of about 30 feet, to the theatre. These two dynamos are run independently from each other, one of them furnishing the current for the lamps in the arcade, the lobby, the boxes, the passages and the upper tier of galleries, while the other dynamo furnishes the electricity for the lamps in the two lower tiers of galleries, the lamps for borders and footlights, and also for the 4 clusters in front of the curtain.

The theatre is lit up every night from 6:30 to 12 o'clock, and the light has received high praise from the public in general as well as from the actors, not only on account of its scenic effect, but also for its non-heating quality, the temperature of the theatre being much reduced by its use; an advantage not to be overlooked in a tropical climate. The difference of heat between the gas formerly used and the Edison lamps now used (external temperature being equal) has in repeated trials been found to amount to 14 degrees Fahrenheit in favor of the Edison light. During the eight months that this light has been used, no accident has happened compelling a suspension of lighting the theatre. The average life of the lamps so far exceeds 800 hours.

MUNICH THEATRE PLANT. The following is from the New York *Post*, October 18th:

"Paul Lindau, the German dramatist and critic, attended some of the experiments with the electric light made in a theatre erected in Munich for the Electrical Exhibition. * * * Lindau thinks that the Edison are far preferable for theatres. They give a mellow, pure, cheerful light, which contrasts favorably with the ghostly blue light of other lamps, to which ladies especially will object, as it makes them look 'pale and sickly, with deep, dark shadows about the eyes, nose and chin.' The insurance companies at first demanded the rate of seven in a thousand, but when the agents had seen some of the experiments they voluntarily came down to two and a-half in a thousand. An Edison lamp was wrapped up in the light clothing of a ballet-girl and then broken. The light was extinguished in a second, and no trace of combustion left. Another lamp was wrapped in gun-cotton and broken with the same result."

THEATRE PLANT AT BRUNN. NO GAS USED. The London *Electrician*, November 25th, contains an article by Mr. Francis Jehl on the lighting of the new theatre at Brunn, by an Edison plant. The following extracts are of interest:

"Brunn, in Moravia, which is the chief manufacturing centre of the Austrian empire, has now beyond doubt the finest installation of electric lighting on this side of the Atlantic. The new theatre, which is owned and governed by the municipal council of that city, is entirely lighted by the Edison system of electric lighting. The building, which occupies a whole square, contains about 1,600 lamps, and has no connection with gas whatever. This theatre has all the modern improvements that can be suggested. * * * All the lights on the stage and auditorium are governed by regulators, and can be varied to any desired intensity. There are six rows of cross lights, each row being divided into three circuits, having 40 lamps each, making in all 720. Each one of these circuits can be regulated, or all together. Then the foot lights, which are divided into two sections, have three circuits each, and contain an aggregate sum of 180 lamps. There are 60 lamps to be used as portable ones, coming from underneath the stage by means of flexible cables. Thirty more lamps, to be worked by flexible cables, come from the first stage gallery, and 60 more, for the uprights on each side of the stage, making 1,050 lamps on the stage alone. The main electrolier has 60 lamps, and 110 more are scattered in different parts of the auditorium, amounting to 1,220 lamps, which are operated by regulators similar to those used for gas. The regulators consist simply of resistance coils, made of German silver wire, and are inserted into each circuit which is required to be operated. Each regulator is divided into

many parts, so that nicety of variation can be obtained. The resistance and size wire used for each regulator depends upon the number of lamps in its circuit. The regulators used here are so constructed that lamps at 16 candle-power can be gradually turned down until the carbon becomes black. Each row of the cross-lights, as before stated, has three circuits, each circuit containing forty lamps, which are of a different colour, namely, red, white and green. The object of this is to produce the different colors of the day; for representing the night the green lamps are regulated, and as morning comes on the red lamps come into play, and then the white. There is also an arrangement to imitate lightning. This is done by having an apparatus which will break a circuit, having a strong current, very quickly. The spark thus produced resembles lightning. * * * The line that conveys the current from the machine house to the theatre is about 350 meters long, and is laid underground about one meter deep. The electric tubes used are of the latest pattern manufactured by the Edison Tube Company, of New York. * * * Of the 1,600 lamps installed in the Brunn Theatre, about 1,000 will burn at a time. There is never any occasion to use them all at once."

NEW YORK CITY. SPICE MILL TO BE LIGHTED. We have received an order for a plant consisting of one Z dynamo and 55 A lamps, to be installed in the store and spice mills of Messrs. B. Fischer & Co., Nos. 325 and 327 Greenwich street, New York city, wholesale dealers in teas, coffees and spices.

A MISSISSIPPI RIVER STEAMER LIGHTED. A plant of one Z dynamo and 120 B lamps has just been installed on the Steamer "Kate Adams," which is to run between Arkansas City and Memphis.

NEW YORK CITY. AMERICAN EXPRESS PLANT. We have just completed the installation of a plant consisting of one K dynamo and 250 A lamps in the offices of the American Express Company, No. 65 Broadway, New York City. The engine which runs this dynamo is supplied with steam from the mains of the New York Steam Heating Company.

PARIS, FRANCE. FIVE MORE EDISON PLANTS. Besides the plants in the dry goods store, Au Bon Marché, and in the St. Lazare Railway Station, heretofore mentioned in the Bulletin, the following plants have been installed and are now running at Paris, viz:

(1). A plant of one Z dynamo with 60 A and 20 B lamps in the Telegraph rooms of the Minister of Posts and Telegraphs.

(2). In the glass-works of M. Pochet, a plant of one E dynamo and 17 A lamps.

(3). A plant of one Z dynamo and 60 A lamps in the Grands Magasins du Louvre.

(4). A plant of one Z dynamo and 60 A lamps in the Banque de France, used for lighting the presses on which the bank notes are printed.

(5). In the establishment of Messrs. Lodde Fils, dyers of feathers and manufacturers of feather dusters, a plant of one Z dynamo with 50 A and 20 B lamps.

PENDLETON, ENGLAND. COTTON MILL PLANT. The Kingston Cotton Mills of Messrs. Wright, Turner & Sons, at Pendleton, near Manchester, England, employing 700 hands, are now lighting by the Edison system. There are at present 500 lights in use, supplied by two K dynamos, but it is intended to increase the capacity of the plant to 1,000 lights.

AMORY MILL PLANT. This installation, mentioned in the Fourteenth Bulletin, has been completed. The following extracts are taken from the Manchester, N. H., *Mirror*, November 9th:

"The Edison electric light has been in operation at the Amory mill scarcely a week, but in this brief period it has more than met the expectations of the agent, who selected it from among the various methods of lighting by electricity now before the public, believing that it was the coming system. His

good judgment in so doing has been highly commended by visitors, some of whom have been manufacturers in contemplation of introducing into their business the electric light. The mill, at present, is provided with 250 lights of 16 candle power each, and the number will be increased in a few days to 275. * * * There is no unpleasant flickering movement, but a mellow glow that gives no offense or pain to the eyes, and renders labor under its influence, as far as the sight is concerned, perfectly unobjectionable. In the few days that the light has been in use the employees of the mill have expressed great thankfulness for its introduction, and all are anxious to work in the rooms where it is in operation. It is located in the upper weaving and cloth room, and partially in the basement weaving room. * * * The lamps now in use, furnish light apiece for four 4-quarter looms, each taking the place of two gas jets. So simple is the machine generating the light that it is easily managed. After it is once started it practically takes care of itself, and the man in charge may busy his attention with other work, only turning now and then to the machine to see that everything is moving smoothly."

CHAIR FACTORY PLANT AT GARDNER. An order has been received from Messrs. Heywood Brothers & Co., Gardner, Mass., for a plant of two L dynamos and 300 A lamps to light their chair factory.

BALTIMORE. ANOTHER COTTON MILL LIGHTED. An installation of a plant consisting of one K and one L dynamo with 100 A lights, has just been completed in the cotton mill of the Mount Vernon Company, Baltimore, Maryland.

PHILADELPHIA. WORSTED MILL PLANT. We have just completed the installation of one K dynamo and 250 A lamps, in the worsted mill of Messrs. Fiss, Banes & Erben, at Philadelphia. Pa. This plant has been increased by the addition of another K dynamo, 250 lamps.

SACO. ANOTHER COTTON MILL PLANT. An order has been given us by the York Manufacturing Company, Saco, Maine, for a plant consisting of three K dynamos and 750 A lamps, to light their cotton mills.

THE EDISON LIGHT IN NEWSPAPER OFFICES. The following extract is from a letter written by Mr. W. A. Croffut to the *Detroit Post*:

"A year ago there were a dozen companies ready to promise to furnish any city with the incandescent lights—that is, to light interiors with small shining bulbs like gas jets—but at this moment Edison's company is the only one actively in the field. It not only occupies the field, but it comes near filling it. Mr. Edison has done all he ever promised to do (if the present results are permanent), but he has not done it as quickly as he anticipated. The first district of this city is lighted—lighted apparently to the satisfaction of all hands.

The *Times* is lighted on the circuit of the first district. I went into the counting-room and editorial-room last night to inquire about it. They spoke warmly in its praise. 'The best artificial light I ever wrote by,' said the manager.

Eighty-one buildings are now using the electric light exclusively, and more are being added every day. Only one engine is being used at present, and it delivers all the light that was ever promised and more. The loss from resistance is estimated at 5 per cent. but the loss from induction or leakage is only 1,000th of 1 per cent. Mr. Johnson tells me—which implies pretty nearly perfection. The light actually furnished is about nine lamps to the horse power. The six engines in the Pearl street station were found not to run uniformly, and are being supplied with new governors. Next week, Monday, they will all be started together, and 400 buildings will be lighted in addition to those at present on the circuit. The next district to be lighted will be the heaviest in the city—that of which Madison Square is the centre.

The *Herald* and *Telegram* establishment is lighted wholly by the same light. I walked over there after completing the above paragraph and saw the editor, Mr. Connery, and the business manager, the foreman, and several of the editorial writers and reporters. 'We feel now,' said the foreman, 'as if we could never again get along without it. It furnishes such a clear, steady light, and the temperature of the composing-room, generally too high, is very much reduced. We shall never go back to gas. As to the cost, I don't know. If it is more than gas, I think our men would be willing to pay the difference, but they say it is cheaper than gas.' The room is about a hundred feet square, and everywhere the little bulbs are bent down over the thick-set cases, each surmounted with a large tin shade.

The testimony of the business manager was to the same effect, but he added: 'It is not only better than gas but cheaper. Being outside of the first district, the *Herald* is lighted from an isolated plant—that is, we furnish our own electricity. We have two engines. The total cost—engines, engineers, dynamos, royalty, interest on investment, and all—amounts to about $7,000 a year. Our gas bills for several years have been $12,000 a year.'

The Edison Isolated Company, besides the *Herald* Building, has already lighted about 140 buildings—mostly manufactories—throughout the country. These include the Philadelphia *Ledger*, *Ohio State Journal*, Davenport *Gazette*, Philadelphia *Public Record*, Baltimore *Sun*, and Boston *Herald*.

Said Ralph Meeker of the *Herald* today:

'It is as much better than gas as gas is better than tallow candles."

CONTRACTS CLOSED BY THE WESTERN EDISON LIGHT COMPANY, CHICAGO. The following plants have been sold by the Western Edison Company, since the last Bulletin:

1). A plant of one Z dynamo with 40 A and 40 B lamps, now in operation in Kern's Flouring Mill, Milwaukee, Wisconsin.

(2). For the works of the Novelty Iron Works, Dubuque, Iowa, a plant of one Z dynamo and 60 A lights. This plant is now running.

(3). A plant of 100 lights, for the Minonk Coal and Coke Co., for supplying light to several buildings and residences in connection with the coal mines of that company at Minonk, Illinois.

(4). A plant of one Z dynamo for the mill of the Batavia Paper Co., Batavia, Illinois. Only 35 A lamps will be used in connection with this plant for the present.

(5). A plant of 177 lights for the premises of the American Express Company at Chicago.

THE ALBERTON PLANT. The following extract, from the Baltimore *Sun*, refers to the plant of the Alberton Cotton Mills, Elysville, Md., mentioned in the last Bulletin as about to be installed:

"Messrs. James A. Gary & Co., who have had the Edison incandescent electric lights placed in the Alberton Cotton Mills, at Elysville, on the Baltimore and Ohio Railroad, say that the lamps have more than realized their expectations. Seventy lights were turned on Tuesday night, forty more will be in use to-night, and the number will be increased to 250 or 300 as soon as possible. Mr. Gary says he does not wish to put himself on record as an advocate of anything until he has experimented personally with it and is ready to prove his assertions, but that he has already been convinced of the

purity, brilliancy, steadiness and safety of the lights, and thinks that in a few days he will be able to demonstrate their practicability for lighting manufacturing establishments. He is very enthusiastic on the subject, and will probably use the new light extensively."

THE SIBLEY MILL PLANT. AUGUSTA, GEORGIA. We take the following extracts, relating to this plant, from the Augusta *Chronicle and Constitutionalist* of October 31st:

"The dynamo or machine for generating the electric current is placed in the basement of the building, and is run by the same water wheels used for running the mill itself. These dynamos are about 6½ feet high by 3 feet square, and have a capacity of 250 lamps each. * * * There is little or no heat in the light, which is also perfectly safe because whenever the glass globe breaks the light goes out instantly. So safe is this system of illumination too, that a 'drop light' can be used about in the lint of the mill and sawdust of the work-shop without danger. Among the loops is a portable lamp that can be attached to any of the sockets by a flexible cord for examining the looms or spindles, for tieing a loose thread, repairing the machine or connecting stripe. It matters not how this portable lamp or any of the others are held, it burns as well upside-down as in any other position. * * * The lights are so arranged in the offices and machine-shops that they can be separately turned out by means of screws or switches, while weaving, spinning or carding-room lamps can be extinguished by rows, sections or together. The lamp being an inverted glass, pear shaped, none of the light is lost. * * * The Sibley Mills seems to have secured the perfection of electric light at last. It is the refinement and concentration of Edison's best efforts, and appears to eclipse every thing in the way of house lighting."

WESTERN EDISON LIGHT COMPANY'S PLANT. The plant of 250 lamps connected with the headquarters of the Western Company is now in successful operation, supplying light for their use in their building Nos. 51 and 53 Wabash Avenue, Chicago, also furnishing light to other offices and stores in adjacent buildings. There is sufficient boiler and engine capacity in connection with this plant to furnish 250 additional A lamps, which it is the intention of the Western Company to make use of at an early date in supplying other parties in the vicinity.

TESTIMONIAL. RESIDENCE PLANT AT APPLETON. The following letter relates to a plant installed at Appleton, Wisconsin, by the Western Edison Light Company, in the private residence of Mr. H. J. Rogers, the President of the local Gas Company of Appleton. This residence is the first one lighted exclusively by the Edison light in the West, Mr. Doane's residence in Chicago not having been completed until afterwards.

"APPLETON, WIS., Nov. 11th, 1882.

WESTERN EDISON LIGHT COMPANY:
CHICAGO, ILL.

GENTLEMEN:—In reply to yours of recent date in relation to the Edison Electric Light in my residence, I have to say that I have about 50 lamps and have used them about 60 days. I am pleased with them beyond expression, and do not see how they can be improved upon. No heat, no smoke, no vitiated air, and the light steady and pleasant in every way, and more economical than gas, and quite as reliable.

Yours truly,
H. J. ROGERS."

APPLETON, WISCONSIN. RESIDENCES LIGHTED. The residence of Mr. H. D. Smith, and that of Mr. A. L. Smith are lighted with the Edison light, the lamps being run by water power. In a recent letter to the Western Edison Light Company, Mr. A. L. Smith speaks as follows of his plant: "I presume you have been informed of the successful lighting of my house by the Edison system. I can only add my own testimony, that in every particular it is most satisfactory. It does seem as if perfection in illumination has been reached."

ENGLAND. TWO OCEAN STEAMSHIPS LIGHTED. The Edison Company of England have lighted the steamship "Tarawera," and are now installing a plant on the "Waihora," both belonging to the Union Steamship Company of New Zealand. Each plant consists of one L dynamo and 156 A lamps driven by a Brotherhood 3 inch cylinder engine.

PHOTOGRAPHING AT NIGHT BY THE EDISON LIGHT. During the progress of the Institute Fair at Boston, mentioned in the Fourteenth Bulletin, the Heliotype Printing Company took two photographic views by the light of the Edison lamps. One of these photographs was of the Western Art Gallery, Institute Fair Building, and the other was of Le Page's picture of Joan of Arc, on exhibition at the Fair. Both photographs were taken at midnight, October 16th and 17th, the exposure being one hour and twenty minutes in each case. The Manager of the Heliotype Company is highly pleased with his success in obtaining good photographs by the incandescent light. He states that he has always failed when attempting to make pictures by the arc light, as its unsteadiness causes effects similar to those when the subject moves. Prints of the above photographs have been sent to us by the Heliotype Company, and are hung in our office.

BORDEAUX, FRANCE. STORE LIGHTED. A plant of one Z dynamo with 40 A and 40 B lamps has been installed in the establishment of Messrs. F. Dandicolle Fils, large provision merchants.

ANGOULEME, FRANCE. MACHINE WORKS PLANT. We have installed a plant consisting of one Z dynamo and 60 A lamps for Messrs. Alex. Laroche, Joubert & Motteau, Angoulême.

VOSGES, FRANCE. HOSIERY WORKS PLANT. There is now running in the factory of Messrs. Paul Schmidt & Fils, manufacturers of hosiery at Vosges, France, a plant of one Z dynamo and one E dynamo and 150 B lamps. This plant is worked very satisfactorily by a turbine wheel.

NANCY, FRANCE. TANNERY LIGHTED. A plant of one Z dynamo and 60 A lamps has been installed in the tannery of M. Luc, at Nancy.

PEXONNE, FRANCE. POTTERY LIGHTED. We have installed a plant of one Z dynamo with 20 A and 20 B lamps, in the porcelain pottery of Messrs. Fenal Freres, Pexonne.

NORMANDY. FACTORY PLANT. A plant of one Z dynamo with 30 A and 40 B lamps has been installed in the cotton spinning factory of M. Philip Bazin, Coude-sur-Noireau.

ROUBAIX, FRANCE. TWO MILLS LIGHTED. A plant of one Z dynamo with 50 A and 20 B lamps has been installed in the cotton spinning mill of Messrs. Motte et Meilleassoux, and a plant of one Z dynamo, 32 A and 56 B lamps in the cotton spinning mill of M. Lefebre, both at Roubaix.

TOULOUSE, FRANCE. CAFÉ LIGHTED. We have installed a plant of one Z dynamo with 40 A and 40 B lamps in the Café de la Comedie, Toulouse.

DANTZIC, PRUSSIA. IMPERIAL DOCK YARD PLANT. This plant, mentioned in the Second Bulletin, has been in operation for some time and is working very satisfactorily. As now running, the plant consists of two Z dynamos with 66 A and 112 B lamps. The lights are used in the machine shops, there being a B lamp at every vice and an A lamp for every machine or lathe, all lamps being furnished with tin shades about 18 inches in diameter, painted dull white inside.

STYRIA. A CASTLE LIGHTED. The Castle of Count Lamberg, of Trautenfelts, Styria, Austria, is now lighted by an Edison plant, which is run from a water-wheel at a river close by.

SEVENTY-EIGHT DEATHS FROM GAS. Among the recent deaths from gas are the following:

"October 7th, Emma Strauss, was found dead in her room at No. 90 Cortlandt Street, in this city, the room being filled with illuminating gas. It is supposed she blew out the gas before retiring. * * * On the 9th of October, Theodore Haske and William Husky were found dead in bed in their room. at the Annex Hotel, Fulton Street, Brooklyn, having been suffocated by gas with which the room was filled. The gas was not turned off. * * * Anna Buck was found dead in her bed, at Jersey City Heights, October 12th. The room was filled with gas, which was escaping from the burner. * * * Mrs. Annie Stademeyer of Newark, N. J., was found in her bed at Hartmann's Hotel, 47 Bowery, New York City, November 29th, unconscious and apparently lifeless. The room was filled with gas, which was escaping from two jets of the centre chandelier. It was stated she could not recover. * * * H. P. Keys of Hillsboro, Pa., was found in a dying condition in his room at the Valentine House, Washington, Pa. October 21st. The room was filled with gas. * * * A man giving the name of Jack Stiles of Brooklyn, was found dead in bed, October 22d, at the United States Hotel, Newburgh, N. Y., suffocated by gas, which was turned on in the room. * * * Hiram Tucker of Boston, was found dead in his room, Sunday, October 22d, suffocated by gas. * * * Timothy Kelly of No. 2297 Tenth Avenue, was found dead in his bed-room, on the morning of October 27th. He had been suffocated by gas, which was turned on but not lighted. * * * On October 28th, Miss Susan Fendick of 111 Fort Greene Place, Brooklyn, was found in her room unconscious, the room being filled with gas. She died soon after. It was found on examination of the gas fixture, that she had neglected to turn the gas entirely off. * * * A gas explosion occured in the Indiana, Bloomington & Western Railway general office, November 26th. The gas had been blown out in the vault, and when D. H. Roche and F. C. Case entered, and lit a match, an explosion followed. All the hair was torn from Roche's head and face. He also inhaled the flame, and, it is believed, will die. Case was injured nearly as badly. The explosion shook the building, and broke every pane of glass in the vicinity. * * * Daniel J. Leamy was found dead at No. 48 Chatham Street, New York City, November 9th, having been suffocated by gas, which had leaked from a defective gas pipe in his bed-room. * * * Lewis McCann and wife were found dead in bed at the Astor Place Hotel, November 13th. They had evidently been suffocated by the gas, which was

turned on. * * * On the 16th of November, Dr. G. W. Weiner was found unconscious in his room at Denver, Colorado. An argand gas burner was on the table, turned on, but not lighted. All efforts to revive the asphyxiated man proved futile, and he died the same day.

The following list of deaths from gas during the last two years, exclusive of all those given above, is taken from the New York *Evening Telegram*, November 24th:

"R. E. Stillwell, North River Hotel, January 8, 1881; P. Nolan, No. 10 First street, January 8; F. Healy, No. 39 Bowery, January 8; T. Coleman, Putnam House, January 8; A. O'Donnell, No. 249 East Thirty-fifth street, January 8; J. Brennan, No. 30 Bowery, January 22; J. Ralm, Central Hotel, Elm and Canal streets, January 24; H. Knapp, Central Hotel, Elm and Canal streets, January 24; Barbara Weiss, No. 955 Third avenue, February 13; Henrietta Braunholder, No. 955 Third avenue, February 13; Sophie Venson, No. 200 West Fifty-sixth street, April 25; Gustav Bertlein, No. 310 Broome street; Frank Watson, No. 28 Bowery, May 9; J. McCarthy, Grand Union Hotel, September 29; Rev. A. Green, Hamilton House, October 20; D. G. Eichberger, Grand Union Hotel, October 31; Three circus men known as Shanghai, Darkey and Lengthy, Putnam House, November 13; J. Wilson, No. 387 Fourth avenue, November 21; W. Zimmermann, January 7, 1882; M. Coyne, January 27; P. Goeghan, No. 226 East Eleventh street, January 31; F. J. Durand, Occidental Hotel; —— James, No. 48 Chatham street, February 26; R. H. Stryker, Bridge Hotel, March 1; J. Hann, No. 38 Bowery, April 26; Two unknown men, June 2; An unknown woman, June 2; P. R. Covert, French's Hotel, June 1; W. Meakin, Eagle Hotel, June 2; Mrs. W. Meakin, Eagle Hotel, June 2; William Thomas, Van Dyke House, June 27; C. D. Miller, of Missouri, Cosmopolitan Hotel, Broadway and Chambers street, July 7; Guiananni Romanillo and Anglo Zamphini, No. 71 James street, August 13; Mrs. Catherine Hottemoth, Bowery Hotel, August 22; Mme. Delveriel, or Josephine Parant, Sturtevant House, September 15; Henry Conkling, No. 108 South street, September 30; Miss Walcott, at the residence of Captain J. H. Bailey, at No. 14 West Twenty-eighth street, October 13; R. B. Reynolds, No. 28 Bowery, New York, January 4. In other Cities: C. S. Thompson, Middletown, Conn., August 4, 1881; Delegation of Indians, Washington D. C., January 8; Robert Angis, Brooklyn, N. Y., October 13; Julia Nelson, Brooklyn, N. Y., October 15; Nena Lawson, Brooklyn, N. Y., October 15; W. T. Craddock, Baltimore, Md., October 31; Mr. Tieford, Philadelphia, Pa., November 18; Mrs. Tieford, Philadelphia, Pa., November 18; C. Reilly, Baltimore, Md., January 7, 1882; F. Hayes, Boston, Mass., March 19; A stonecutter at Port Jervis, N. Y., April 25; A minister, Troy, N. Y., May 4; Emile Acrosie, steamer Providence, May 5; Lillie J. Brant, steamer Providence, May 5; J. W. Langley, steamer Providence, May 25; J. A. Osterhoudt, Rondout, N. Y.,

June 4; Patrick Meehan's two children, at Pullman, Ill., July 12; Andrew H. Van Riper, Preakness, Passaic, N. J., Passaic Hotel, September 15; M. Maclear, No. 359 Montgomery street, Jersey City, North River Hotel, October 17; A. E. Stowe, Saratoga, N. Y., October 24."

TWO THOUSAND FIVE HUNDRED AND SEVENTY-ONE FIRES FROM GAS, LAMPS AND CANDLES. The report of George H. Sheldon, Fire Marshal of the city of New York, for the year ending December 31st, 1880, shows that in this city from June, 1868, to January, 1881, there were 345 fires caused by ignition of escaping gas, 31 fires caused by explosions of gas, 1,287 fires from the upsetting of kerosene oil lamps, 1 from the upsetting of a lighted candle, and 907 fires caused by window curtains, goods in stores or show windows, christmas-trees, clothing, drapery, netting, paper, woodwork, &c., taking fire from gas jets, candles and lamps; the total number of fires aggregating 2,571.

WEST POINT MILITARY ACADEMY PLANT. A plant of one Z dynamo and 60 A lamps has been ordered, for use at the United States Military Academy, West Point.

BOSTON. DRY GOODS STORE PLANT. We have received an order for a plant consisting of two K dynamos and 500 A lamps, to light the dry goods store of Messrs. R. H. White & Co., at Boston Mass.

CHICAGO. MR. DOANE'S RESIDENCE LIGHTED. The residence of Mr. John W. Doane, a new building opened for the first time on the evening of November 10th, is lighted with an Edison isolated plant consisting of 250 lamps and one K dynamo. The house is lighted throughout with the Edison light, gas having been entirely omitted, and no facilities for any other light introduced. The lights are distributed as follows :

BASEMENT: Kitchen 5 lights, pantry 2, refrigerator 1, laundry 5, large hall 3, smaller halls 2, wine room 1, servant's hall 2, servant's dining-room 2, closet and bath 2, laundry-heater 1.

PARLOR FLOOR: Vestibule 1 light, main hall 20 lights, reception-room 10, parlor 22, including grate light, library 9, dining-room 16, including grate light, smoking-room 11, cloak-room and closet 2, elevator 1, back hall 2, butler's pantry 2, butler's store-room 2.

SECOND FLOOR: Main hall 24 lights, back hall 3, in seven bedrooms 47 lights, in two dressing-rooms 6 lights, in six bath rooms 7 lights, closets 2 lights.

THIRD FLOOR: Ball room 24 lights, main hall 20, billiard room 4, closets 2, back hall 3, servant's rooms 10, spare bedroom 6, bath-room 1.

MISCELLANEOUS: In the dome 20 lights, stairs leading to dome 1, engine room 4, stable and stalls 12, coach house 4, coachman's and stable-help's quarters and bath-room 4.

The following extract is taken from the Chicago *Tribune* of November 11th:

"Mr. Doane has recently completed what is probably the finest house west of New York, and it was fit that he should inaugurate it by a celebration of his silver wedding. This fete occurred last evening at No. 1,827 Prairie avenue, and it was a grand social success. The interior of the house is as exquisitely rich as taste and art can make it, and last night it presented a scene of grandeur and beauty rarely witnessed. Mr. Doane has illuminated his house with 250 of the Edison electric incandescent lights, and they made the house brilliant in the extreme, and brought out the elegant toilets in all their rich colors. From the curb to the door of the vestibule there was spread an awning lighted up with electric lamps. * * * In the reception-room, from the centre of the ceiling, there hung a chandelier of smilax, to which were appended the electric lamps, in the centre of which was a rich and large bouquet of roses. The elaborate mantel of the parlor was hidden by banks of exquisite flowers, while from out the brass hearths in all the rooms and in the halls shone forth electric lights, so arranged as to imitate a glowing fire, while directly in front were entwined exotic vines, flowers, etc."

HOLYOKE PLANTS. The following is taken from the Holyoke *Transcript*, October 28th:

"The Edison electric light at the Whiting paper mill, No. 2, is working successfully. The plant has a capacity of 120 half lamps distributed in all the rooms of the mill where artificial light is used, nine in front of the Windsor Hotel and four at the Front street entrances of the opera house. At the mill the engine-room has the same number of lamps as formerly of gas jets, and is furnished a better light, while in the remaining rooms the illumination is about the same as before. A few days ago John Rathburn, an experienced engineer at the Hadley Thread mill, took indicator diagrams from the engine driving the electric plant at the Whiting No. 2 mill and found the net consumption of horse-power after deducting the friction diagram to be 5.8, although the guarantee of the electric Company admitted of a consumption of nine horse-power on the work. The 360 Edison lights at the Appleton street mill of the Merrick Thread Co., will be in operation within two weeks, the workmen being now busy arranging the apparatus."

THE BALTIMORE SUN PLANT. We take the following extract from the Baltimore *Sun* of October 13th:

"A notable event in the history of the electric light is the introduction of the incandescent system for the first time in Baltimore, the city which was so prominently connected with the first practical test made of electrical telegraphy in May, 1844. THE SUN is the first to use here this neat and safe means of illumination, adopting Edison's invention. This lamp was some time ago exhibited in Baltimore as a curiosity, but it is now for the first time employed practically to take the place of gas. All parts of THE SUN IRON BUILDING from the engine-room beneath the level of the pavement to the composing-room on the fourth story, (both included,) are fitted with the elegant pear-shaped globes which distinguish the incandescent from the arc system. These lamps give out a clear, soft light, in comparison with which the gas jet has a tame and dingy appearance. The scale on which the new light supplants the old may be inferred from the fact that the composing-room floor alone is fitted with sixty lamps. The advantage of a light which produces little heat and no unwholesome gases will be appreciated in all large establishments where a great number of persons are employed."

RUBBER FACTORY PLANT AT READING. The Mayall Rubber Company have ordered a plant of one L dynamo and 150 A lamps, to be installed in their rubber factory, at Reading Mass.

ASHBURNHAM. CHAIR FACTORY PLANT. We have received an order for a plant of one L dynamo, and 150 A lamps, to light the chair factory of the Boston Chair Company, at Ashburnham, Mass.

DIVIDEND BY THE ISOLATED COMPANY. The Edison Company for Isolated Lighting has declared a dividend of 10 per centum, payable January 20th, out of the profits of the first year's business. It is proper to state that the Isolated Company has parted with none of its territory, and sold no territorial rights, the profits on the first year's business having been earned exclusively from the sale and installation of isolated plants. Tempting offers have been received from parties desiring to purchase territorial rights, but the policy of the company during the year of its existence, has been to retain all its territory, pending at least a partial development of the commercial value of the business. The profits, therefore, do not represent any receipts from the sale of territory or licenses, or any receipts from the profits of manufacturing, but they represent solely and exclusively what has been made by selling and installing dynamos and lamps for isolated incandescent lighting. It is said, and we believe truly, that this is the first time a dividend has ever been declared by any electric light company from the profits of selling machinery and lamps, exclusive of profits derived from manufacturing, and the sale of licenses or territory.

EDISON FACTORY LIGHTED. FRANCE. The Société Industrielle et Commerciale Edison have installed a plant for lighting their own works, consisting of one K dynamo and 400 A and B lamps. This factory is now in full operation turning out dynamos, lamps, &c., for installing Edison plants in France, and in other parts of Europe. It is located at Ivry-sur-Seine, near Paris.

BALTIMORE. THE KNABE PIANO FACTORY PLANT. The following extract from the Baltimore *Sun*, November 23d, relates to one of our plants just started in the piano factory of Messrs. William Knabe & Co.:

> "EDISON ELECTRIC LAMPS.—Several departments of the Messrs. Wm. Knabe & Co.'s piano manufactory, Eutaw and West streets, were lighted last night with the Edison incandescent lamps. There are 150 lamps in all, about 125 of which are movable for a distance of twelve feet in any direction. Heretofore the departments have been closed early, as gas was not used for fear a lighted match might be thrown by accident where it would do damage, but now the men will be able to work later, and thus benefit themselves as well as their employers, as many of them work by the piece. As is well known, THE SUN IRON BUILDING was the first in Maryland to make use of the new light. Then followed Mr. Jas. A. Gary's mill at Elysville; then Wm. Knabe & Co., and now arrangements are being made to introduce it into the Mt. Vernon Company's mills at Woodberry."

TESTIMONIAL FROM FACTORY PLANT AT LENNI. The following testimonial has been received relating to the plant installed at Lenni, mentioned in the last Bulletin:

> "PHILADELPHIA, December 2d, 1882.
>
> TO THE EDISON COMPANY FOR ISOLATED LIGHTING:
>
> In reply to your enquiry as to the Edison Electric Light you installed at the Park Mount Cotton & Woolen Mills, Lenni, Pa., I would say they give us the fullest satisfaction, and are every way up to your guarantee for light and efficiency: and although we have been running several weeks we have not yet broken a single lamp.
>
> The guarantee you made as to the power consumed is also more than borne out in practice. We do not feel the power used by your dynamo.
>
> JOHN BURNLEY,
>
> Secretary and Treasurer."

NEW BEDFORD. GRINNELL MILL PLANT. An order has been received from the Grinnell Mill, for a plant consisting of three K dynamos and 800 A lamps to be installed in their cotton mill at New Bedford, Mass.

PHILADELPHIA. WOOLEN MILL PLANT. An order has been received from Messrs. Clark & Keen, for a plant of one K dynamo and 200 A lamps, to be installed in their woolen mill at Philadelphia, Pa.

ERIE, PA. MACHINE SHOPS LIGHTED. We have received an order from the Stearns Manufacturing Company, Erie, Pa., for a plant consisting of one L dynamo and 150 A lamps, to be installed in their machine shops.

MR. WOODBURY ON THE EDISON LIGHT AT HOLYOKE. The following extract from the Holyoke *Transcript*, October 28th, is of interest touching the economy of the Edison light:

"At a meeting of the Manufacturers Mutual Insurance Co., held in Boston last Wednesday, Mr. Charles J. H. Woodbury, a mechanical engineer of much prominence who is retained as an expert by that company, read an exhaustive paper on electric lighting, a portion of which is of much local interest.

Mr. Timothy Merrick, of this city, authorizes him to give the facts respecting his experience with the Edison System in the Merrick Thread Company's mill No. 3. This mill runs all night, five nights in the week for 51 weeks per year, using light 2,869 hours per annum. It was lighted by 95 burners with city gas, costing $2.13 net, which amounted to $225 per month. Ninety-five Edison B burners (eight candle-power) were substituted for the gas. In the first 1,000 hours five lamp-carbons had broken, and October 20 they had been in use 1,278 hours, and eleven had broken.

Allowing that the lamps average six months use, the cost of lighting is made up as follows:

190 lamps, at $1.00,	$190.00
Interest and depreciation,	153.50
6 horse power, at $10.00,	60.00
Annual cost of Edison light,	$403.50
Monthly " " "	33.62
Monthly cost of Gas,	225.00

The results from these lamps are very satisfactory, and certainly in excess of what would have been obtained if the lamps had been forced beyond their normal capacity.

The Holyoke Water Power Company furnishes water-power very cheaply; and the result may be interesting if we hold the Edison Company to their

minimum guarantee, and also charge the dynamo with four pounds of coal per hourly horse power:

4.78-100 renewals of 95 lamps, equals 454 lamps at $1.00,	$454.00
Interest and depreciation,	153.50
30.74 tons of coal, at $5.75,	176.81
Annual cost of Edison light,	$784.31
Annual cost of Gas,	2,700.00
Monthly cost of Edison light,	65.36

which is equal to gas at 65 cents per thousand.

'The mill is situated,' says Mr. Woodbury, 'at the base of a high bank and is only eleven feet, six inches between floors, so it is very hot in summer, and Mr. Merrick informed me that it would have been impossible to run the mill nights during the extremely hot season last summer if the help had been subjected to the heat and vitiated air from the burning gas.'

Speaking of improvements Mr. Woodbury says 'that they will certainly come, but will probably refer to attachments rather than to the more permanent portions of the plant, as the machines already deliver 80 or 90 per cent. of the motive power into electricity upon the conducting wires.' * * * More than 33 per cent. of the arc lighting plants on premises insured by the mill Mutual Insurance Companies, have caused fires but he gives no instance of one caused by an incandescent system, and it is positively asserted that no fire or injury to person has ever been caused by an Edison system.

In conclusion Mr. Woodbury said 'Electric lighting should be encouraged on account of its inherent qualities of safety. Any system that is in conformity to the insurance regulations is also in the best condition electrically.' "

GHENT, BELGIUM. A plant of one Z dynamo and 60 A lamps has been installed in the offices and works of Messrs. De Smedt and d'Hanis, Ghent.

ADDITIONAL PLANTS SINCE LAST BULLETIN. The last Bulletin contained a list of all our Isolated Plants in the United States up to that date. There were 123, aggregating 21,998 lamps. By mistake one plant was omitted from the list, that of the Merrick Thread Company, Mill No. 2, Holyoke, Mass., one K dynamo and 360 B lamps. Since the date of the last Bulletin, October 14th, we have received orders for 29 additional plants, aggregating 6,506

lamps. We have also received orders to increase 5 plants already installed, the aggregate increase of lamps being 328 lamps. The total number of isolated plants up to the date of this Bulletin is 153 plants, 29,192 lamps. The list given below contains the Merrick Thread Company's plant, mentioned above, also the orders for installations received since the date of the last Bulletin.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Merrick Thread Co., Mill No. 2	Holyoke, Mass.	Thread Works	360
John S. Adams	Pittsburgh, Pa.	Str. "Kate Adams"	120
American Express Co.	New York City	Express Co.	250
Heywood Bros. & Co.	Gardner, Mass.	Chair Factory	300
Mount Vernon Co.	Baltimore, Md.	Cotton Mills	400
Fiss, Banes & Erben	Philadelphia, Pa.	Worsted Mills	500
York Manufacturing Co.	Saco, Me.	Cotton Mills	750
U. S. Military Academy	West Point	Academy	60
R. H. White & Co.	Boston, Mass.	Dry Goods	500
Mayall Rubber Co.	Reading, Mass.	Rubber Factory	150
Boston Chair Co.	Ashburnham, Mass.	Chair Factory	150
Davis & Proal	Baltimore, Md.	Storage Batteries	120
Whiting & Campbell	New York City	Paper Hangings	60
R. Y. McAden	Lowell, N. C.	Cotton Mill	100
Albion Paper Co.	Holyoke, Mass.	Paper Mill	150
Arnold Print Works	North Adams, Mass.	Print Works	150
Portage Straw Board Co.	Akron, Ohio	Straw Boards	130
Bay State Sugar Refinery	Boston, Mass.	Sugar Refinery	150
Light & Force Co.	New York City	Storage Batteries	15
St. Charles Hotel	New Orleans, La.	Hotel	150
B. Fischer & Co.	New York City	Spice Mills	55
Bijou Theatre	Boston, Mass.	Theatre	644
Grinnell Mill	New Bedford, Mass.	Cotton Mill	800
Clark & Keen	Philadelphia	Woolen Mill	200
Kern's Flouring Mill	Milwaukee, Wis.	Flour Mill	80
Novelty Iron Works	Dubuque, Iowa	Iron Works	60
Minonk Coal & Coke Co.	Minonk, Ill.	Residences &c.	100
Batavia Paper Co.	Batavia, Ill.	Paper Mill	35
American Express Co.	Chicago, Ill.	Express Co.	177
Stearns Manufacturing Co.	Erie, Pa.	Machine shops	150

Total	6,866
Lamps to be added for increased plants	328
Plants reported in 14th Bulletin, aggregating	21,998
Total lamps to this date	29,192
Total number of plants	153

SANTIAGO, CHILI. SMALL CENTRAL STATION STARTED. The local Edison Company at Santiago, began November 4th., to furnish light to subscribers. The start was made on that date with an equivalent of 150 A lamps which were increased within the next few days to 200, exclusive of the lamps in the station. The current is at present distributed over two main conductors, one 650 feet in length, the other 425 feet. The lights are distributed among twelve dry goods stores, five large commercial houses, a large café and billiard room, and several other shops. Mr. Stewart writes that he is running three Z dynamos to supply the light and that thousands of people have visited the station and the buildings where the lights are placed. He states that all the subscribers to the light are satisfied, that he is unable to supply fixtures as rapidly as consumers require them, and that the local press is enthusiastic in praise of the enterprise. The local gas company has supplanted the old gas burners with new ones with an enlarged capacity, free of charge, but the public sentiment is largely with the Edison light.

TESTIMONIAL FROM THE WAMSUTTA PLANT, NEW BEDFORD. The following testimonial from Mr. Kilburn relating to the large Edison isolated plant now in use in the Wamsutta mills, is copied from the *Cotton, Wool and Iron and Boston Journal of Commerce:*

"In answer to an inquiry as to the result of the introduction of the Edison system of electric lighting in the Wamsutta Mills, we have received the following letter:

WAMSUTTA MILLS,
NEW BEDFORD, MASS., NOV. 10, 1882.

Editor Cotton, Wool and Iron:

The Edison system of electric lighting was introduced into our No. 6 mill, Sept. 14, 1882, and has been in constant use ever since that date, lighting the entire mill. The plant cost about $12,000, and consists of three K dynamos, so called, each of the capacity of 250 A lights of 16 candle power each, making a total of 750 lights. The lights are so arranged that one will light four looms, giving an equal amount of light

to each loom. We formerly used two four-foot gas burners for the same purpose. In other parts of the mill the arrangement is such that one lamp lights about the same space as two four-foot gas burners. The whole system from the word go has moved along without a hitch of any name or nature, and is giving entire satisfaction. We like it for several reasons. It is a better light than gas; it is as cheap as gas at $1 per 1000 feet; there is no smoke or heat from it; it is safer than gas; and, best of all, it does not vitiate the air we live in—for this reason alone we should use it, if it cost more than gas. The dynamos are operated by one of our machinists, requiring but a small portion of his time, say an hour and a half per day for the year. The power required is, by actual test, one horse power for 8.6 lights of 16 candle power each. The lamps are guaranteed to last 600 hours; and, as a well constructed mill requires light but about an hour per day, or 300 hours per year, the lamps would last two years. The cost for power, taken in connection with the power to drive our mills, is very light, at the night end of the day. We are unable to detect any increase in the consumption of coal, but the fires are probably burned a little lower; therefore, from this data, I should compute the cost of lighting our mill, which contains 51,000 spindles and 1,072 forty inch looms, as follows, putting the power at $30 per year per horse power:

87 horse power for 300 hours at $30	$261	
375 lamps at $1 each	375	
Labor operating dynamos	90	$726
Interest and wear and tear on plant at 8%.....		960
Total cost of electric light.............		$1.686

To light with gas would require 1200 four-foot burners, which would consume 1,440,000 feet of gas in the 300 hours:

1,440,000 ft. gas at $1 per thousand ft....	$1,440
Interest, etc., on cost of piping mill, at 8%.............	320
Total cost of gas..........................	$1,760
Deduct cost of electic light..........................	1,686
Leaving....................................	$74

Showing $74 in favor of electric light with gas at $1 per thousand feet.

Yours respectfully,
EDWARD KILBURN, Agent."

Referring to the testimonial of Mr. Kilburn, the following is an extract from an editorial notice which appeared in the *Cotton, Wool and Iron and Boston Journal of Commerce:*

"The fact that the Edison light had to be applied to the East gallery at the New England Manufacturers' and Mechanics' Institute fair, after two or three systems had been thoroughly tried, to the disgust of the parties in charge of the gallery, is another item which manufacturers will do well to consider, and if any of our friends call for Mr. Burdick or Mr. Robinson, who are in charge of the galleries at the fair, they can obtain a candid statement of facts, as well as perhaps some of the other exhibitors, all of which most decidedly proves our statement of last week, that Mr. Edison had to-day the only electric light which is adapted to manufacturers' uses."

LAWRENCE. SMALL CENTRAL STATION PLANT. The Edison Electric Illuminating Company of Lawrence, Mass., have purchased ground for a central station and are putting in a small plant for central station lighting, susceptible of subsequent enlargement as the business developes. We hope to give a detailed account of this plant in the next Bulletin.

INSURANCE COMPANIES AND OUR LIGHT. The following extract is from the report of the Board of Directors of the Edison Electric Illuminating Company of New York City made to the Stockholders at the annual meeting, touching upon the satisfactory and agreeable relations existing between that Company and the Insurance Companies. It merits especial attention:

"It gives us great pleasure to make a formal recognition of the courteous and intelligent manner in which our local Board of Underwriters have discussed and treated the subject of the wiring of buildings by our Company for electric lighting. The fact that we were wiring many hundred buildings in a single section of the city for the purpose of lighting them by our system, necessarily rendered the question of how the work should be done so as to avoid the danger of fire, one of great importance for the underwriters to determine. The entire novelty of the subject, together with the fact that no precedents existed and no rules had ever been propounded anywhere in the world to meet the emergency, made the matter one of still greater delicacy and difficulty. It was however admitted from the first that the interest of the underwriters and of ourselves were identical. Both of us wished to avoid fires. Fires in the one case would entail losses upon insurance companies, and in the other would create a prejudice against electric lighting, and we felt very deeply

that in the introduction of such an entirely new system of artificial illumination, any prejudice of such a nature would be highly injurious. Mr. Edison had, however, from the beginning of his inventions in electric lighting, developed his system with an especial eye to its safety from fire. Accordingly we took special pains to point out this fact to the Board of Underwriters and to endeavor to obtain from them and their experts a full and unbiased examination of the merits of our system in this regard. The intelligence and fairness which they brought to the investigation of the details of our system, were met on our part by a full and free disclosure and explanation of everything connected therewith. This resulted in the adoption of certain rules by the Board of Fire Underwriters, which have now become the standard rules in the matter.

In our First District in this city, the Board of Underwriters required that in every case a special inspection of buildings should take place before they were lighted. Accordingly, whenever we have made connections between our street mains and the interior wires, and before turning on the current, we have always notified the Inspector. In no cases have we been subjected to any troublesome delay by him or by any other of the insurance officials, and the rapidity with which we have been enabled, week by week, since the plant in the First District was started, to connect buildings and start the light, has been owing in no small degree to the fact that, although the inspections have been rigid and thorough, they have always been made with promptness and dispatch."

ISOLATED COMPANY. CIRCULAR ISSUED BY DIRECTORS TO STOCKHOLDERS. The Directors of the Edison Company for Isolated Lighting have issued the following circular to the stockholders, relative to the recently declared dividend and the proposed increase of stock, and copies have been mailed to every stockholder:

"The Edison Company for Isolated Lighting,
65 Fifth Avenue.

New York, December 6th, 1882

To the Stockholders:—

The Board of Trustees are pleased to be able to inform you that the business of the company for the first year of its operations has been very satisfactory. The early part of the year was necessarily occupied in preparations and canvassing, so that it may be said that the profits have been realized largely within the last six months, and notwithstanding the expenses incident to the organization of a new industry, the net profits actually earned up to the end of the present year, warrant the Board in the declaration of a dividend of ten per centum on the Capital Stock of the company, which has accordingly been re-

solved upon, and which will be payable on the 20th day of January next to the Stockholders of record, at the closing of the books on the 4th of January, as hereinafter provided.

The company has been somewhat embarrassed, even in this its first year, by the insufficiency of its capital for the prosecution of its large and constantly increasing business. The large amount of work at all times in progress, together with the stock of Dynamos, Engines, and other materials necessarily kept on hand to enable us to fill orders promptly, requires the constant use of a large amount of money. The Board is fully satisfied that to enable the company to execute promptly future orders, an addition to its present resources will be required, which even the retention and use of the year's earnings would not fully supply. The Trustees have therefore resolved to call a special meeting of the Stockholders, in pursuance of the notice herewith enclosed, to be held on the 30th day of December inst., to act upon the proposition to increase the Capital Stock of the company, from five hundred thousand dollars to one million dollars.

Of the increased stock 51 per cent. ($255,000), will be issued to the Edison Electric Light Company as provided in the contract between the two Companies, and the remainder, 49 per cent., ($245,000) will be offered for subscription at par to the Stockholders of record at the closing of the books, on the 4th of January next.

The Transfer books will be closed at the Central Trust Company, on the 23d inst., for the meeting of the Stockholders, and remain closed until Tuesday the 2d day of January, when they will be re-opened for two days, closing on the afternoon of the 4th of January, and Stockholders of record at the last named date will, if the increase of Capital is authorized at the Stockholders' meeting, be entitled to subscribe for one additional share of Stock for each share of the present Capital Stock standing in their names at that time.

The transfer books will be re-opened on Monday, January 22d.

The option to subscribe to the increased Stock, will remain open to Stockholders of record at the closing of the books, on the 4th of January, until the close of business on Wednesday the 10th of January. Any amounts not then subscribed will be disposed of as may be directed by the Board of Trustees.

The terms of subscription as fixed by the Board of Trustees requires the payment of fifty dollars per share, at the time of making such subscription, the remaining fifty dollars per share to be subject to the call of the Board in such sums and at such times as it may determine.

Forms of subscription will be sent to each subscriber immediately after the closing of the books, January 4th.

If you cannot be present personally at the meeting of the Stockholders on the 30th inst., please sign the enclosed proxy, have the same witnessed and return it to the undersigned before the day fixed for the meeting.

By order of the Board,

C. GODDARD, SECRETARY."

ANNUAL MEETING OF STOCKHOLDERS OF LIGHT COMPANY. OFFICERS ELECTED. DIRECTORS' REPORT.

The fourth annual meeting of the stockholders of the Edison Electric Light Company was held at No. 65 Fifth Avenue, New York City, October 24th, 1882. The following Officers and Directors were elected for the ensuing year: President, S. B. Eaton; Vice-President, Edward H. Johnson; Secretary, Calvin Goddard; Treasurer, E. P. Fabbri; Directors, Norvin Green, S. B. Eaton, G. P. Lowrey, Thomas A. Edison, E. P. Fabbri, Henry Villard, James H. Banker, Calvin Goddard, Edward D. Adams, Frederick W. Foote, J. F. de Navarro, Edward H. Johnson, and W. H. Meadowcroft.

The following extracts from and reference to the Report of the Board of Directors submitted to the meeting are of interest:

"Since the last annual meeting the stock of the company has been increased fifty per centum, namely, from four hundred and eighty thousand dollars to seven hundred and twenty thousand dollars. This increase was recommended by your Board, January 5th, 1882, and was approved at a special meeting of the Stockholders, called for the purpose, January 31st, 1882. Only sixty per centum upon this increased stock has been called in."

The report next refers to the license granted to the Edison Electric Illuminating Company of New York, also to the satisfactory progress being made by Mr. Edison with the Electric Railway at Menlo Park, and to the progress being made in lighting railway trains. The report then goes on as follows:

"The isolated business and the lighting of steamships were two subjects to which especial attention was called in the last annual report. It was evident that a large amount of capital would be required to develop these kinds of lighting, and that either the capital of our company would have to be increased to raise such capital or a new company with adequate capital would have to be formed. There was strong objection on the part of some of your Board against changing the policy of our company from what it had always been, namely, that of merely paying the expenses of experiments and of taking out and holding patents and not of investing capital in the actual business of lighting, and in view of this feeling on the part of some members of the Board the decision was finally reached that a new company should be formed with adequate

capital for the special purpose of carrying on the isolated business. Accordingly, on November 4th, your Board consented to the formation of such a distinct company, to take a license from this company for the isolated, mining and marine business throughout the United States for all territory outside of actual gas limits January 1st, 1882. Such company was subsequently organized, with a capital of five hundred thousand dollars, of which amount two hundred and fifty-five thousand dollars of fully paid stock was issued to this company for a license. The contract between the Isolated Company and this company was executed April 26th, 1882. The business of the Isolated Company has grown rapidly and has already assumed large proportions. * * *

Notwithstanding the great expense attending the inauguration of such an entirely new business a handsome dividend has already, in the first year, been earned by the Isolated Company from the sale of machines and lamps, and the future of the business is exceedingly promising.

Pursuant to a resolution of your Board passed November 4th, 1881, appointing a committee to confer with a committee from the Gramme Electrical Company touching the question of this company joining that organization, satisfactory arrangements were consummated, and the contracts between our company, the other companies composing the Gramme Company, and the Gramme Company itself, were executed April 20th, 1882. Your Board are of opinion that our company will derive benefit in the future from being a member of the Gramme organization, not so much on account of the Gramme Patent, which, owing to the peculiar and original construction of the Edison dynamo, is probably of no especial importance to our company, but on account of the means afforded by the Gramme Company for harmonizing conflicting interests. * * *

During the past year a number of electric light companies have made overtures to our company for consolidation. In some cases they have sought to sell their patents to us out and out; in others to exchange licenses. These overtures have always been met by us in a courteous manner and the matters involved thoroughly examined. Sometimes written opinions have been obtained by us from the counsel of the company, also from Mr. Edison. But in no case have your Board considered it for the interest of our company either to buy out the business of such companies as have offered to sell, or to amalgamate with those seeking consolidation, or otherwise to make any arrangements."

Here follows a list of the subordinate companies to which the Light Company has granted licenses, together with a statement of the general policy of the company touching the formation of subordinate companies, to the effect that inasmuch as the Edison Patents on incandescent lighting give to the Light Company a monopoly of the busi-

ness of incandescent lighting, and inasmuch as the business has not yet been so fully developed as to enable the company to correctly determine the value of a license for any given locality, the general policy of the company, to which only a few exceptions have been made, has been to postpone for the present the granting of licenses for specific localities and the formation of subordinate companies to work such licenses. The report then speaks of the installation of the experimental village plant at Roselle, New Jersey, now being installed, and then concludes as follows:

"The financial condition of the company is fully set forth in the Treasurer's report herewith submitted. It shows that during the past year the income of the company has exceeded its outlay, and that a balance is carried over to another year which will go far towards paying the expenses of another twelve months, without using future receipts for that purpose. Considering the safe and conservative policy adopted in the management of the business of the company, a policy which has not been intended to secure immediate returns by the sacrifice of large territory or by disposing of licenses before their value shall have been fully and experimentally determined, the fact that the company has already become more than self-sustaining is highly encouraging. Your Board consider the outlook as full of promise, and they confidently expect, in view of the successful development of the past year the most gratifying results in the future."

ANNUAL MEETING OF THE EDISON ELECTRIC ILLUMINATING COMPANY OF NEW YORK CITY. DIRECTORS' REPORT. ELECTION OF OFFICERS. The second annual meeting of the Stockholders of this Company was held at No. 65 Fifth Avenue, December 12th. The following Officers and Directors have been elected for the ensuing year: President, Norvin Green; Vice President, S. B. Eaton; Treasurer, E. P. Fabbri; Secretary, Calvin Goddard; Directors, Norvin Green, S. B. Eaton, Thomas A. Edison, E. P. Fabbri, James H. Banker, Henry Villard, R. M. Gallaway, J. Hood Wright, G. P. Lowrey, J. F. de Navarro, E. G. Fabbri, Calvin Goddard, and W. H. Meadowcroft.

The following extracts are taken from the report of the Board of Directors submitted at the Stockholder's Meeting:

"Since the last annual report the installation of the First District has been completed, and on September 4th the plant was started. This event has created wide-spread comment in both scientific and financial circles. In view of the fact that it constitutes the first attempt to distribute electrical current for lighting and other purposes, over a large area, from a central station, and in view of the further fact that it is but a short time since the highest scientific authorities in the world pronounced such an attempt not only impracticable but also impossible, the actual starting of the plant in the First District awakened the deepest interest. It is therefore with great satisfaction that your Board congratulate you upon the successful opening of the First District, and upon the bright prospects for the future of the Company's business of electric lighting in this city, rendered possible by the success thus far attending the Pearl Street Station. * * * Soon after the last annual report, that is to say, about the last of December, the laying of the underground mains was suspended on account of bad weather and the freezing of the ground. For nearly two months, in consequence of these obstacles, but little progress was made with the underground conductors, but about the last week in February work was resumed and before the end of June the street mains were all laid. The wiring of houses in the First District was completed in February, when 946 houses had been wired with a capacity for 14,311 lamps. These places thus wired were distributed throughout the First District as follows: Spruce street, 12; Ferry street, 4; Peck slip, 4; Beekman street, 107; Ann street, 31; Fulton street, 166; John street, 73; Burling Slip, 1; Platt street, 8; Maiden Lane, 78; Liberty street, 19; Cedar street, 36; Pine street, 28; Wall street, 56; Park Row, 3; Nassau street, 68; William street, 97; Gold street, 10; Dutch street, 4; Cliff street, 9; Pearl street, 43; Water street, 19; Front street, 46; South street, 24.

* * * The underground conductors were proportioned to distribute the maximum current to be generated by the full power which the station will be capable of producing when its equipment shall be fully completed and are ample for that purpose, but your Board was of the opinion that the most prudent policy was to finish only one of the two buildings in the first instance. They thought that the experience gained in the installation of the apparatus in the first building might possibly suggest some improvements which could be availed of in equipping the second building. The plant so far erected at the Central Station, 255 and 257 Pearl Street, consists of six steam dynamos, with the necessary boilers and appliances for regulating and controlling the current. The engines attached to the

dynamos have each a normal capacity of 125 H. P., and a maximum of 200 H. P., making a total maximum capacity of 1,200 H. P. The steam dynamos weigh 30 tons each, making the aggregate weight of the six 180 tons. The total net-work of underground conductors is 95,000 feet, including mains on all the block fronts, street intersections, bridge intersections and feeders. The plant in the First District, as stated above, was started, and the District lighted up for the first time at 3 P. M., September 4th. Since then the Station has been running day and night without stopping. No serious obstacle has been met with and, except as regards a single defect connected with the steam engines, no unexpected trouble has arisen. The result of Mr. Edison's part of the work, namely, the electrical apparatus and everything appertaining thereto, has exceeded our anticipations, the only special trouble having been caused by purely mechanical matters, chiefly the regulation of the steam engines. In this respect we have experienced no little disappointment.

* * * In the last annual report mention was made of an investigation on the part of a Committee of the Board of Underwriters, touching the safety from fire of the Edison system of electric lighting. Since then rules have been adopted by the Underwriters governing the wiring of buildings for electric lighting. These rules were not promulgated until after we had finished the wiring of many of the buildings in the First District, but since they were promulgated the rules have been strictly complied with. Regarding the buildings wired before the rules were published, the Board of Underwriters have in most cases approved the wiring as finished before the rules were adopted, thereby recognizing the intelligent and successful efforts on the part of our wiring department, even before the Underwriters had thoroughly discussed the subject to wire buildings in such a manner as to be free from all danger of fire.

* * * The total number of buildings connected in the First District up to this date is 226, wired for 5,013 lamps, of which 2,976 are in regular use. When the First District was lighted up no charge was made for the use of the light. Your Directors were of the opinion that owing to the irregularity of the light, resulting from the imperfect governing of the engines, no charge should be made until the station was running light satisfactorily to our own engineers. For the last few weeks, however, this irregularity has been substantially removed, and we have accordingly now begun to charge. It is the present intention to make the bills for the light payable monthly, as is the custom with gas bills, and to make the charge on a basis of one dollar per thousand candles, which is equivalent to about the present price of gas, ($2.25 per thousand feet). Regarding the selling of power in the First District, Mr. Edison is now engaged in constructing motors of different sizes. We expect a large demand for power and now that selling of light has been successfully started, especial attention will be

given to equipping the District with facilities for furnishing power. The light having now been in use over three months in the First District consumers have had sufficient experience to qualify them to form a correct opinion as to its merits. We have made especial efforts to ascertain what these opinions are, and both through the employees of the Company and through others who were total strangers to the consumers, we have endeavored to ascertain how the light is liked. There has been but one response. The consumers of the light are unanimous in the opinion that it is entirely satisfactory and that it is in all respects superior to gas, or any other illuminant. So strong are the expressions of opinion in this respect that we already begin to feel that the only possible mistake made in the First District is that the installation will be found to be too small, that is to say, that the completed plant, large as it will be, will prove too limited to enable us to furnish all those who wish to become our customers. As regards the equipment of the second building at the central station no arrangements have as yet been made. The policy of your Board in this respect has been to defer beginning work on the second building until the plant in the first building shall have been run and taxed up to its maximum for a sufficient length of time to furnish reliable data, based on experience, touching both the scientific and the financial questions involved. The success of the station during the period which it has been run, now exceeding three months, satisfies us, however, that there is no longer room for doubt touching these questions, and that, (possibly) at an early date, it will be found prudent and desirable to go on with the installation of the second building.

In the last annual report a list was given of the isolated plants then installed or in process of installation in this city. Some additional installations have since been made. A list of all these isolated installations in New York City, including those mentioned in the last annual report, is as follows: Hinds, Ketcham & Co.; Nathan & Dreyfus; Manhattan Railway Co.; New York Herald Building; E. S. Jaffray & Co.; H. K. & F. B. Thurber & Co.; American Bank Note Co.; J. Pierpont Morgan; Hotel Everett; Professor Henry Draper; Max Ams; Aitken, Son & Co.; Everett's Hotel; American Express Co.; B. Fischer & Co.; and Whiting & Campbell. Some attention has been given to deciding what will probably be the next district to be lighted in this city. The decision reached has thus far been in favor of what is known in our Engineering Department as the Twenty-Eighth District of New York City, namely, the area bounded by Twenty-fourth and Thirty-fourth Streets, and Madison Avenue and Eighth Avenue. A careful canvass of this district has been made. It shows that it presents a singularly attractive field for electric lighting. Whereas the number of gas jets in the First District is about 18,000, the number in the Twenty-Eighth is near 44,000,

and the number of sewing machines in the Twenty-Eighth District is 2,309, many of which will probably become customers for power. The other details of the canvass of the Twenty-Eighth District are equally encouraging as regards the rich field presented in that district for an electric light plant. After the First District shall have been completed in all its details, and its success both scientifically and financially fully established, as we have no doubt will be the case, without unreasonable delay, the next step taken by the Company will probably be that of installing a plant in the Twenty-Eighth District.

In closing this report your Board desire again to tender to the Stockholders their sincere congratulations over the successful installation and starting of the First District. From our experience thus far in connection with the actual running of that District, for a period now extending over three months, your Board are of the opinion that the present successful development of the Edison system of electric lighting, supplemented by certain improvements which Mr. Edison has recently made, will open an attractive field for investment for the purpose of extending the Edison system of lighting, not only over the Twenty-Eighth District, but over the remaining districted sections of the city."

ANNUAL MEETING OF ISOLATED COMPANY. DIRECTORS' REPORT. OFFICERS ELECTED. The first annual meeting of the stockholders of the Edison Company for Isolated Lighting, was held November 21st, at No. 65 Fifth Avenue, New York City. The officers and directors elected for the ensuing year, are as follows: President, S. B. Eaton; Secretary, Calvin Goddard; Treasurer, E. P. Fabbri; General Manager, M. F. Moore; Directors, Thomas A. Edison, S. B. Eaton, Calvin Goddard, Edward H. Johnson, E. G. Fabbri, M. F. Moore, and W. H. Meadowcroft.

The following extracts are taken from the Report of the Board of Directors, submitted at the meeting:

"When this company was formed a year ago, the business of isolated lighting was entirely undeveloped, and no data existed whereby the future development of the business could be foretold. At that time Mr. Edison, was making but one size of isolated dynamo, namely, the Z dynamo; we had no reliable steam engine; the innumerable details relating to installations, such as

fixtures, safety catches and other appliances, were still either unperfected or were not manufactured on any considerable scale; there were then but eight isolated plants installed or in process of installation, and but one or two of them were in operation; we had no force of employees, beyond a few connected with the New York office of the Company, and but little preparation had been made for the development of the business. Such was the condition of the isolated business when the Company was formed.

One of the first things done by the Company, after its business had been systematized, was to take up the subject of procuring additional dynamos, besides the Z dynamo; also suitable engines. At a meeting of the Board of Directors, held January 26th, 1882, the subject of additional sizes of dynamos was discussed, and arrangements were made with Mr. Edison for the construction of experimental dynamos of additional sizes. The result was the production of two commercial dynamos, in addition to the Z dynamo, one being known as the L or 150 light dynamo, and the other as the K or 250 light dynamo. Arrangements are now being made for the construction of a still larger dynamo for isolated lighting, probably one of 350 lights.

Regarding engines, great difficulty was experienced in obtaining an engine adapted to our especial needs. The engine which was the first to be tried, proved unsatisfactory. After much testing and discussion the engine finally adopted as the one best suited to our business, was the Lawrence engine, manufactured by Armington & Sims, at Lawrence, Mass. During the year that firm has moved its business from Lawrence to Providence, where a substantial company has been formed to develop their engine business, and although our Company is now taking the entire product of the machine works of that company, we are still unable to get engines enough to supply our orders.

The policy adopted by our Company at its start was to call in only a small amount of money, and to develop the business, until it had passed its experimental state, only on a limited and economical basis. This policy was rigidly adhered to. Installments were called in only as fast as the necessities of the business, viewed from a conservative stand point, required. The growth of the business, however, has been so steady and reliable, that the entire capital has now been called in, and is being safely and profitably employed in the business, and additional capital is needed.

The business of the Company for the past year, up to November 19th, has amounted to 137 installations of isolated plants (of capacities varying from 15 to 800 lights, respectively), in mills, factories, hotels, steamships, newspaper offices, dry goods stores, &c. The aggregate of the lamps in these 137 installations is 25,426. Most of these plants are in factories, but many are on steamboats and in newspaper offices.

The newspaper offices lighted with Edison plants are the New York *Herald*, the Philadelphia *Ledger*, the Philadelphia *Record*, the Ohio State *Journal*, the Boston *Herald*, the Baltimore *Sun*, the Davenport *Gazette*, and the newspaper and printing office of Weed, Parsons & Co., Albany, N. Y.

The light has proved itself a valuable means of artificial illumination for newspaper work in all its branches, chiefly on account of the steadiness and non-heating quality of the light.

Lighting steamships promises to be quite an important and profitable branch of our business. The plant on the steamer City of Worcester, New York City, has given such satisfaction, that an order has been given for us to light the new steamer, Pilgrim, which is now being finished. We also lighted one of the boats running from Baltimore to Norfolk, and our light was so satisfactory that a similar plant was ordered for another boat of the same line. We are now lighting a steamer on the Ohio River, and there is some prospect of considerable business in connection with lighting other steamers on the Western rivers.

Our light gives uniform satisfaction. We have received a large number of testimonials from our customers extolling its merits. But perhaps the best evidence of satisfaction which our plants give is the fact that not one plant which we have installed has been rejected. Indeed many of the plants have been largely increased, after trial. * * *

We should state that all our installations have been made on a strictly one-price basis. It has been the rule of the Company, from which no exception whatever has been made, not to vary prices in any instance, but to maintain our published price list invariably. It may be that in a few instances orders have been lost by an adherence to this rule of business, but it is our belief that the business on the whole has been benefited by a rigid adherence to the one-price principle.

A new and probably an important branch of the future business of the Company deserves especial mention. We refer to the lighting of small villages and non-gas towns by small central stations. An experimental plant of this description is now being installed at Roselle, N. J., at the joint and equal expense of this Company and of the Edison Electric Light Company. It is expected that this village plant will be started during the month of December of this year, and should it prove as successful as anticipated, the business of lighting by village plants will form perhaps the most important branch of the future business of our Company. When we look back and note the progress that from a small beginning has been made during the year in isolated lighting, we may reasonably expect that the coming year will show not only a large increase in that class of business, but that the business of village plants, provided the Roselle installation succeeds, will develop with equally steady and rapid success.

Our Company has not as yet parted with any of its territory, but still retains all originally purchased from the Edison Electric Light Company, namely, all non-gas towns, villages, &c., in the United States, January 1st, 1882. Nor have we formed or granted license to any subordinate companies. Thus far our business has been handled from the home office, through agents who represent us in soliciting orders and in looking after the details of our business. The regular local agents of the Company at present are as follows:

Mr. Spencer Borden, in New England; Mr. John Hoskin, in Eastern Pennsylvania, Delaware and Western New Jersey; Mr. G. O. Fairbanks in Ohio, except Cincinnati and its county; Mr. E. A. Clarke in Maryland, District of Columbia and Western Pennsylvania; Mr. W. P. Hix in Virginia; Mr. G. D. Bancroft, who has heretofore represented us at Holyoke, Mass., but is now about starting for Colorado to represent us there; Mr. G. S. Ladd in California; Mr. A. J. Pattison in Utah; Mr. W. W. Monroe, Cohoes, N. Y.; Mr. B. P. Ward, Rochester, for Western New York; Mr. W. H. Souther, Louisville, and Mr. George F. Houghey in Cincinnati and its county. We have also made arrangements with the Western Edison Light Company, to represent our interests in the territory granted to them by the Light Company, namely, in the States of Iowa, Illinois and Wisconsin. The business of soliciting orders in New York City and its vicinity, is mostly done by canvassers connected directly with the home office.

The subject of increased capital requires early attention. The present capital of the Company, scarcely sufficient for the business up to the present time, is inadequate for such immediate growth of business as we may reasonably expect. The terms upon which we are now selling plants are as follows, namely, bills payable in thirty days after the installation is completed. This is equivalent to giving the purchaser thirty days to try the light. It is probable that ultimately these terms may be made more stringent, but for the present they should not be changed. Inasmuch as we are obliged to pay cash for most of our supplies, including engines and dynamos, it is apparent that if our business increases, we shall not be able to provide for the increase without additional capital. An examination of the financial condition of the Company, as appears by the report of the Secretary, shows that the finances of the Company are in a satisfactory and healthy condition. But it is evident that we have scarcely sufficient capital for the present necessities of the business and that the amount is entirely inadequate for such increased orders as are already coming in. * * *

It is with great pleasure that we congratulate the Company upon its present prosperous condition and future prospects. In establishing the business, we have had to contend not only with the usual obstacles incident to the starting of a new enterprise, but also with the utter novelty of the business itself. There were no precedents for us to follow, and, especially as regards the development of the vast mechanical details of the business, we have had none of the aids and benefits that are always to be drawn from the experience of others. We can truly say that we have actually been the pioneers in the practical introduction of incandescent electric lighting, and that what our Company has accomplished, namely, the successful installation of incandescent electric lighting, is the first achievement of its kind. To accomplish this successfully on a large scale, within the short space of one year, and, at the same time, to establish the business on a dividend earning basis during this, the first year of its existence, is, in our judgment, a matter for congratulation."

No. 16.
FEBRUARY 2, 1883.

SIXTEENTH BULLETIN.

The Edison Electric Light Company,

65 FIFTH AVENUE, NEW YORK.

February 2d, 1883.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

CONTENTS.

FIRST DISTRICT, NEW YORK CITY. The success of this plant is now established beyond question. It has been in operation day and night without stopping one minute since it was first started, September 4th. The only obstacle ever encountered, namely, the purely mechanical one of the regulation of the engines, has now been entirely overcome. The engines are running smoothly, the light is steady, and our customers are entirely satisfied.

We were lighting at the date of the Fourteenth Bulletin, October 14th, 85 houses; at the date of the Fifteenth Bulletin, December 20th, 225 houses; and at this date we are lighting 310 houses, wired for about 6,225 lamps. All the buildings now lighted have been inspected by the Board of Fire Underwriters, and certificates authorizing the use of our light have been granted in every case Additional connections are being made daily. Meters are used in all the buildings, and our bills for lighting, based on the amount of current shown by the meter as having been consumed, are now presented regularly each month to our customers. Generally speaking, our bills are found to be about the same as gas bills for corresponding months. Our customers not only pay our bills, but express themselves as delighted with the light.

NEW YORK "TIMES" LIGHTED. The New York *Times* is lighted from the Pearl Street Station by means of a branch underground connection with our regular underground conductors in the First District. The plant consists of 288 lamps, distributed as follows:

Composing Room	115
Mailing "	12
Press "	77
Reporters "	14
Editorial "	27
Halls	12
Offices	31
Total,	288

The fixtures, prepared under special orders from the Times Company, were manufactured by Messrs. Bergmann & Co. The success of our light in the Times Building is a good illustration of the entire success of our underground system, because the building is not only

at such a distance from the Central Station as to submit the carrying capacity of our conductors to a severe test, but being also located outside the limits of the First District, and beyond the borders of the net-work of conductors, special conductors had to be laid and connected with the system in a manner not originally contemplated. Everything, however, has worked perfectly, and the light is giving entire satisfaction. Several other newspapers have applied to be connected.

THE EDISON SUIT AGAINST THE SWAN LAMP FOR INFRINGEMENT, LONDON. The patent suit mentioned in the Thirteenth Bulletin, as having been commenced in London against the Swan lamp, is being pressed as rapidly as possible by the Edison Company. The fundamental principles of incandescent lighting are at issue in the suit. Thus far the matter has been brought before the English Court on two minor points, both of which were decided in favor of the Edison Company. The first was on the question of compelling the Swan Company to keep an account of their manufacture of lamps pending the trial, so as to afford the Edison Company a correct basis for fixing damages; and the second was on a question between the two companies touching the services of eminent counsel, claimed by both companies. On both these preliminary issues the decision of the Court was in favor of Mr. Edison. The Edison Company in London is devoting itself with great energy to preparing for the trial, and every effort will be made to have it take place as soon as the case is reached on the docket of the Court, probably this Spring.

THE UNDERWRITERS AND ELECTRIC LIGHTING. By request of the National Board of Fire Underwriters and the United Fire Underwriters in America, Henry Morton, Ph. D., President of the Stevens Institute, and William A. Anderson, Esq., of the New York

Board of Fire Underwriters, have prepared a work on the Underwriters' requirements touching electric lighting. The title of the book is as follows: "Electric Lighting and the Underwriters' Standard Requirements in Reference Thereto with Instructions for the Proper Inspection of Electric Light Equipments." The work, which has been prepared with unusual care, is illustrated with cuts of dynamos and electrical appliances used in house lighting, and will at once prove a most valuable and instructive assistant to the various electric light companies and their workmen.

TESTIMONIAL FROM THE PARK MOUNT MILLS, LENNI. We have received the following testimonial regarding the plant mentioned in the Fourteenth Bulletin, now running in the Park Mount Mills, Lenni, Pa.:

> "We have been lighted at the mill by the Edison electric light, 127 hours, since November 2d, 1882. We have burned out only two lamps in that time, but several lamps have given out from other causes. We are much pleased with the Edison light and value it very much.
>
> (Signed) THE PARK MOUNT MILL,
>
> JOHN BURNLEY;
>
> Sec'ty, and Treas."

YVÄSKYLÄ, RUSSIA. SAW MILL PLANT. A plant of one E dynamo with 40 lamps has been installed in the saw mill of M. Johnson at Yväskylä, Russia. This is probably the most northerly Edison plant in the world, the town being situated between the 62d and 63d degrees of latitude.

It is interesting also to note in this connection, that the common council of Yväskylä, which is a town of 2000 inhabitants, have announced their intention of putting up a Central Station of 500 A lamps.

NEWTON, MASS. WORSTED MILL LIGHTED. We have received an order for a plant consisting of two K dynamos and 500 A lamps, to be installed in the mill of the Nonantrim Worsted Company, Newton, Mass.

THE "ELECTRICIAN" ON THE BRUSH STORAGE BATTERY. The New York *Electrician* in its issue of January, 1883, speaks as follows of the Brush storage battery:

"The recent exhibition of the Brush secondary battery in New York, has again attracted public attention to the general subject of the so-called storage of electricity. The information given in regard to the construction of this battery is of the most general character, and is entirely insufficient to enable us to form any intelligent opinion with respect to its novelty or efficiency, or as to its chances of commercial success. It is stated by Mr. Brush, and by those who have charge of the exhibition, that the battery consists of lead plates and the ordinary solution of acidulated water, and that the plates are prepared by some secret chemical process, by which greatly improved results are obtained. Very high efficiency is claimed for it in a general way, and those who are interested in it appear to be confident that it will prove economical and reliable in use. It is to be observed, however, that similar claims were made in regard to the Faure battery and others, which have been before the public for some time, and, so far as we are able to judge from the best information accessible to us, none of these batteries have yet proved available for ordinary use, and it appears to be the better opinion that the storage system will have a much more restricted field than its advocates claim for it. Such tests of the Faure battery as we have seen reported seem to indicate that a higher efficiency than 50 per cent. cannot be safely relied upon in practice. That is, only about one-half of the current expended in charging the battery can be recovered in useful work, and even this efficiency would probably be considerably impaired unless the battery were used within a comparatively short time after charging it. Aside from the loss of current, the expense of the battery appears to be quite a serious item. Taking, for instance, the plant at the Theatre des Varietes at Paris, it is stated that 265 Swan lamps are used, and are supplied by about 100 Faure batteries. The *total weight* of the batteries is stated to be *14 tons, 10 tons of which is active material.* No doubt, in certain exceptional cases, such batteries will prove extremely useful, but, for general use in a system of distribution from central stations, we think the advantages have been largely overestimated. It is true that the conductors for distributing the current may be considerably reduced in size, but the cost of constructing and maintaining the secondary batteries would, in a large measure, make up for this advantage, if not entirely counterbalance it. The

advantages claimed by way of reducing the capacity of engines and dynamos have also been considerably overrated. Experience seems to show that no machinery can be relied on for constant use, working anything like 24 hours a day. Considerable time must be allowed for making necessary repairs and overhauling machinery, and very reputable mechanical engineers have expressed the opinion that no practical advantage could be gained by running engines and machines more than 12 hours per day, as the increased wear and tear and liability of accident would counterbalance the saving in the cost of the plant. It is obvious, also, that the introduction of the storage battery largely increases the complication of the system. No doubt there would be considerable demand for a really efficient secondary battery for use in places where expense is not a controlling consideration, but we by no means share the sanguine views of those who believe that such a battery would effect a revolution in present methods of lighting."

ROYALTY PAID IN ENGLAND UNDER THE EDISON PATENTS. The British Electric Light Company, Limited, have made an arrangement with the Edison Electric Light Company, Limited, London, to manufacture lamps under the Edison English patents. This disposes of the question of infringing the Edison patents, which was at issue between these two companies. Under the arrangement now made, the British Company pays down a fixed amount in cash, and a continuing royalty on every lamp made or used. In consideration of these payments the Edison Company abandons its proposed suit for infringement, and grants a license to the British Company to manufacture incandescent lamps.

SAN FRANCISCO. SUGAR REFINERY PLANT. A plant of one L dynamo, 150 A lamps, is being installed in the California Sugar Refinery.

CUBA. LIST OF ISOLATED PLANTS. Mr. A. Montamat, representing the Edison light at Havana, has furnished us with the following list of installations in Cuba:

(1). A plant of one Z dynamo with 52 A and 20 B lamps on the sugar estate "Esperanza," belonging to Don Felipe de Pelayo, situated in the Cardenas Jurisdiction, Cuba.

(2). On the sugar estate "Socorro" in Sierra Morena, belonging to the Count of Casa Ibañez, a plant consisting of one Z dynamo with 61 A and 4 B lamps.

(3). A plant of one Z dynamo, 3 A and 110 B lamps on the sugar estate "San Lino," situated in the Jurisdiction of Cienfuegos, and belonging to Messrs. Montalvo and Brothers.

(4). A plant of one Z dynamo with 44 A and 40 B lamps, on the sugar estate "Constancia" belonging to Messrs. Apesteguia, also situated in the Jurisdiction of Cienfuegos.

The plant in the "Louvre," also the plant in the Albisu Theatre, have been described in previous Bulletins.

OUR LIGHT AT WEED, PARSONS & CO'S., ALBANY. The following is taken from the *Albany Evening Journal*, January 9th:

"Messrs. Weed, Parsons & Co., have just put up in their extensive printing, binding and lithographic establishment two of Edison's dynamo-machines which communicate with 600 incandescent lamps placed in the several rooms of the building. The machines are driven by the steam engine which moves the entire machinery of the establishment. These lamps have been in service for several weeks in the principal composing room of the office, and have given entire satisfaction to the compositors. The light is clearer, greatly exceeds the ordinary gas jet in brilliancy, and, by the manner of its adjustment, concentrates the illumination just where it is most needed.

These lamps have been tested to stand a continuous strain of 700 hours—or the equivalent of more than two years of steady use where the average of night work does not exceed two or three hours a day. These lamps are distributed throughout the establishment as follows:

Engine room	6
Boiler room	3
Press rooms	58
Counting room	14
Composing rooms	207
Bindery	178

Lithograph room	82
Electrotype rooms	26
Railroad ticket room	23
Law Journal editorial room	6
Stereotype vaults, escape stairs, &c	32
	645

Several large work-shops and factories in this country and in Europe have adopted this system of illumination, but Weed, Parsons & Co's establishment is the first (except in Trask & Co's business office) where it has been introduced in this city."

STEAMSHIP LIGHTED. EXHIBITION AT GREENOCK, SCOTLAND. The following extracts are taken from the *North British Daily Mail*, Glasgow, December 4, 1882:

"On Saturday afternoon the magnificent new screw steamer Tarawera, built and engined by Messrs. Denny of Dumbarton, for the Union Steamship Company of New Zealand (Limited), was thrown open to the public at the Albert Harbour, Greenock. The steamer is lighted up with the Edison Incandescent System of Electric Lighting, and is the first vessel in this country to which this system of lighting has been applied. The number of lamps in the vessel is 150, and the driving power is supplied by a Brotherhood 3-cylinder direct-acting engine. This engine drives the dynamo-electric machine direct. The dynamo is of the size known as the "L" or 150 light machine. * * * The space occupied in the vessel by the generating machinery is 9 feet by 2 feet 6 inches. The lamps throughout the ship are of 16 candle-power, and they are so arranged in the state rooms, &c., that the light in each lamp can be turned off or on at pleasure by means of a tap similar to an ordinary gas cock. The simple turning on of this tap lights the lamp. The "wiring" throughout the ship is done with a thin copper wire, covered with four separate coatings of insulating material, and at every point where the wires branch off to supply lamps a safety fuse is inserted. This safety fuse contains a piece of lead wire, which fuses immediately upon the addition of any excess of current beyond what is nominally intended to be supplied. Complete immunity from fire is thus secured. An exhibition of the working of this light was given on board the Tarawera on Saturday. The private view lasted from two till five o'clock, after which the vessel was thrown open to the public at a nominal charge, the proceeds to be handed over to the Greenock Infirmary. For the private view a large number of invitations were issued to gentlemen interested in shipbuilding and the electric light, and, notwithstanding the extremely wet weather that prevailed during the afternoon and evening, the vessel was thronged with ladies and gentlemen during the

time the exhibition lasted. * * * The arrangements for Saturday's exhibition were conducted by Mr. C. T. Grant, of 160 Hope Street, Glasgow, the Agent for the Edison Electric Lighting Company, and the practical arrangements for the lighting of the ship were under the charge of Mr. Macdonald, the electrician for the company in Scotland. The exhibition of the light was an entire success, and general satisfaction was expressed on all hands, not only with the incandescent system of lighting, but with the whole appearance of the steamer. The shaft tunnelway of the Tarawera is lighted up with two of the lamps, and this application of the light seemed to give immense satisfaction to the many engineers and shipbuilders who visited this part of the steamer."

DOCKS LIGHTED. PORTLAND, OREGON. The docks of the Oregon Railway and Navigation Company, Portland, are lighted with Edison lamps. Mr. J. C. Henderson, the Consulting Engineer of that Company, makes the following statement touching the comparative merits of the arc and incandescent systems, for lighting docks. He says that "as to the relative value of the arc and incandescent systems for lighting the several departments of the Company, he prefers the Edison for all offices and covered docks or buildings, for the reason that the lamps can be more readily distributed and thus give a much better and greater diffusion of light than it is possible to obtain from a limited number of arc lights."

We are further informed by Mr. Henderson that the two systems of incandescence and arc were experimented with on their docks, both at the same time, with a view to determine upon the most desirable light for the purpose of illuminating docks where freight was being handled constantly during the night. Mr. Henderson informs us that a great many mistakes were formerly made in trans-shipment of freight, which were directly traceable to the fact that the light from the arc lights was so dazzling as to partially blind the clerks on the dock, so far as to render it very difficult for them to distinguish the marks and numbers on the packages. For this reason, after a thorough and practical test, it was decided to adopt the Edison

system for covered docks and offices, in preference to any known system of arc lighting.

In this connection we are permitted to make the following extract from a recent letter of Messrs. Goodall, Perkins & Co., Agents of the Oregon Railway and Navigation Company:

"At our request, Engineer Van Duzen thoroughly investigated the electric light question at Portland, and by comparing notes we have concluded that the Edison light is preferable for the purpose of handling freight, over the arc light. It is said that the arc light is bad to work by, that sometimes the eyes get in such condition that they are not well able to read marks, whereas, with the Edison light they are able to read marks very readily."

THE "REPUBLICAN" ON STORAGE BATTERIES. The following intelligent criticism on storage batteries is taken from the Springfield *Republican*, January 14th:

"The sytem of storing electricity is not yet sufficiently developed to be of practical use, and it is very doubtful if it ever becomes of so great commercial value as its advocates prophesy. Various persons have from time to time announced the invention of storage batteries which could be used in electric lighting, but none of these have had other than scientific value. In the Faure system, for instance, forces are never converted at a loss of less than 50 per cent. Mr. Brush, inventor of the arc light, claims very high efficiency for his storage battery too, but like the similar devices, it has not yet proved available for ordinary use. M. Faure's batteries, as they are now constructed seem altogether impracticable, not alone because only half of the current used to charge them can be recovered, but on account of their cost. One hundred of these batteries were required to supply 265 Swan lamps in the Theatre des Varietes, at Paris, and their total weight was 14 tons. When Mr. Brush has perfected his storage batteries, he intends to introduce the arc light into private houses, and claims that it will be powerless to harm the inmates. This is all very well, but it remains to be done. The ordinary Weston and Brush arc lights, however, cannot be used for interior lighting without great danger to life and property, as events have proved; for each light is acted upon by the whole force of the powerful electric current, which, coming in contact with so good a conductor as the human body, can have but one effect. In Edison's Incandescent system which, it is claimed, answers all requirements and combines perfect illumination with entire safety, there is a return current from each lamp, instead of a continuous current, as in the arc system, which returns only when the last lamp on the circuit has been reached. The electric current

in Edison's system is so feeble that the wires at any part of the system, and even the poles of the generator itself can be held in the bare hand without the slightest perceptible effect."

BRÜNN THEATRE. This plant, mentioned in the last Bulletin, is running with great satisfaction. The following item is taken from the Vienna *Neue Freie Presse*, December 18th:

"The Union of Engineers and Architects went to Brünn to-day to visit the new theatre of that city, and above all to study its lighting. About 200 persons took part in this excursion, amongst them Vice-President Pfaff, and the celebrated Architects Schmidt and Hansen. The Union was received at the Station by the Mayor and the professors of the Polytechnic School. In the evening the members attended at the performance, and expressed their entire satisfaction with the Theatre and its lighting by the Edison system."

MISSISSIPPI STEAMER "KATE ADAMS" LIGHTED. The plant on the steamship "Kate Adams," mentioned in the Fifteenth Bulletin, has been successfully started. The following account of it is taken from the Memphis *Avalanche*, December 21st:

"Those who were on board of this elegant steamer last night saw for the first time in this city the results of the labors of the wizard of Menlo park. Major Adams in fitting up his brag boat determined that the various modern improvements which contribute so much to our comfort and pleasure should be embraced in her outfit, and chief among these was placed the Edison electric light for the illumination of her saloon and staterooms. * * * The steadiness is what constitutes the great difference between the incandescent and the arc systems of electric lighting. Wherever it has been introduced, those who are using it would not allow gas to again take its place, even if the cost of lighting by this system were greater, which we are happy to say is not the case. * * * So economically is this light produced under this system, that where an amount of power is required during the day, the lighting by night, if necessary, can actually be furnished free of expense. * * * We congratulate Maj. Adams upon the enterprise which he has exhibited in being the first to place this beautiful light upon western waters, and upon a steamer which it will grace so admirably. Mr. Waters, who is in charge of the light, with much courtesy showed its simplicity to the many ladies and others who thronged the cabin of the peerless Kate Adams."

HELSINGFORS, RUSSIA. PAPER FACTORY PLANT. A plant of one Z dynamo and 60 A lamps has been installed in the establishment of Mr. George Riecks, probably the most important factory in Russia for tapestry and fancy papers. This plant is in use from 8 to 10 hours each day.

Mr. Riecks recently said to our engineer that "the Edison light is more like sunlight than any other illuminant, and for mixing colors and making a distinction of all the finest tints it cannot be approached."

PHILADELPHIA, PA. LARGE CLOTHING STORE PLANT. An order has been received for a plant of one K dynamo and 250 A lamps, to light the clothing stores of Messrs. A. C. Yates & Co. 602 and 626 Chestnut St., Philadelphia.

MR. JOHNSON'S CHRISTMAS TREE. The following description of Mr. Johnson's Christmas tree, written by Mr. Croffut, is taken from the Detroit *Post and Tribune*, December 31st:

"Last evening I walked over beyond Fifth avenue and called at the residence of Edward H. Johnson, vice-president of Edison's electric light company. There, at the rear of the beautiful parlors, was a large Christmas tree presenting a most picturesque and uncanny aspect. It was brilliantly lighted with many colored globes about as large as an English walnut, and was turning some six times a minute on a little pine box. There were 80 lights in all encased in these dainty glass eggs, and about equally divided between white, red and blue. As the tree turned the colors alternated, all the lamps going out and being relit at every revolution. The result was a continuous twinkling of dancing colors—red, white, blue, white, red, blue—all the evening, like the tree laden with lambent splendor that sparkles above the fountains in Aladdin's palace. I need not tell you that the scintillating evergreen was a pretty sight—one I can hardly imagine anything prettier. The ceiling was crossed obliquely with two wires on which hung 28 more of the tiny lights; and all the lights and the goblins and fantastic tree itself with its starry fruit were kept going by the slight electric current brought from the main office on a filmy wire. The tree was kept revolving by a little hidden crank below the floor which was turned by the electricity. It was a superb exhibition."

PLANTS ENLARGED AFTER TRIAL. A gratifying evidence of the satisfaction given by our isolated plants is the fact that many plants have been increased after trial. A partial list of these plants is as follows:

(1). Seymour, Sabin & Co., Stillwater, Minn. The first installation was two Z dynamos and 250 B lamps, now increased to one K dynamo and 250 A lamps.

(2). Danforth Locomotive Works, Paterson, N. J. The first installation was one Z dynamo and 60 A lamps, now increased to one L dynamo and 150 A lamps.

(3). The Pemberton Company, Lawrence, Mass. The first installation was one Z dynamo and 125 B lamps, now increased to two L dynamos and 300 A lamps.

(4). The Merrimac Manufacturing Company, Lowell, Mass. has increased its plant from two Z dynamos and 250 B lamps, to one K dynamo and 250 A lamps.

(5). The Merrick Thread Company, Holyoke, Mass. The first installation was one Z dynamo and 120 B lamps, which has been increased to one K dynamo and 400 B lamps.

(6). The Wamsutta Mills, New Bedford, Mass., inserted a plant consisting of one Z dynamo and 60 A lamps, which has now been increased to three K dynamos and 750 A lamps.

(7). Messrs. Weed, Parsons & Co., Albany, N. Y. The first installation was one Z dynamo and 120 B lamps, now increased to two L dynamos and 600 B lamps.

(8). Mr. Max Ams, New York City, originally had a plant of one E dynamo and 15 A lamps, which he has since increased to one Z dynamo and 60 A lamps.

(9). Messrs. Sayles & Washburn, Mechanicsville, Conn. The first installation was one Z dynamo and 120 B lamps, now increased to one L dynamo and 300 B lamps.

(10). Messrs. George Urban & Co., Buffalo, New York, increased their plant from one E dynamo and 15 A lamps, to one Z dynamo and 60 A lamps.

(11). Messrs. H. K. & F. B. Thurber & Co., New York City. The first installation was one Z dynamo and 60 A lamps, first increased to two Z dynamos and 96 A and 80 B lamps, and again increased to one K dynamo and 250 A lamps.

(12). Messrs. Norton, Brother & Co., Chicago, Ills., first had an E dynamo and 15 A lamps; now increased to one Z dynamo and 60 A lamps.

(13). The Sibley Manufacturing Company, Augusta, Georgia, have increased their plant of two K dynamos and 450 A lamps by the addition of one L dynamo, 150 lamps, thus making two K and one L dynamos and 600 A lamps.

(14). Messrs. Fiss, Banes & Erben, Philadelphia, whose first installation was one K dynamo, 250 A lamps, have doubled their plant by the addition of another K dynamo and 250 A lamps, making the total plant two K dynamos and 500 A lamps.

(15). The Baltimore *Sun* plant, has been increased from an L dynamo and 150 A lamps to a K dynamo and 250 A lamps.

(16). The Worumbo Manufacturing Co., Lisbon Falls, Me. The first installation was one L dynamo and 150 A lamps, now increased to two K dynamos and 500 A lamps.

(17). Messrs. J. B. Stetson & Co., Philadelphia, Pa. have increased their plant from two Z dynamos with A and B lights, to two K dynamos and 500 A lamps.

18). The Eastman Dry Plate Co., Rochester, N. Y., have increased their plant from an E dynamo and 15 A lamps to one Z dynamo and 60 A lamps.

(19). The Davenport Gazette Company, Davenport, Iowa, has been using a Z dynamo and B lamps for many months past. This plant has been increased to an L dynamo and 150 A lights.

N. K. FAIRBANKS & CO'S PLANT. LARD WORKS. ST. LOUIS. A plant of 178 A lamps is being installed in the Lard Works of N. K. Fairbanks & Co., St. Louis, Mo. This plant is elsewhere mentioned in this Bulletin, in connection with the list of plants installed by the Western Edison Light Company. It is outside of their territory, but special arrangements were made with that company for the installation.

DRY GOODS STORE PLANT. DETROIT. A plant consisting of 175 A lamps is being installed in the dry goods store of Messrs. Metcalf Brothers & Co., Detroit, Michigan. This plant is elsewhere mentioned in this Bulletin, in connection with the list of plants installed by the Western Edison Light Company. It is outside of their territory but special arrangements were made with that Company for the installation.

THE LONDON "TIMES" ON THE EDISON LIGHT IN AMERICA. In view of the unfair statements about our business lately printed in many newspapers in this country, it is refreshing to read the following fair and correct article published in the London *Times*, January 5th:

"In New York, the central station in Pearl-street was opened on the 4th of September last, since which date there has been no intermission in the production of the current, either day or night. The pressure on the 20 miles of mains is constant and equal, and the additions to the system average

something like 80 lamps per diem. The remarkable simplicity of administration cannot fail to impress even the ignorant visitor. The regulation of the system is carried on by means of an automatic device, by which, when the lamps on the system are below their proper candle-power, a green lamp is switched into circuit, and when the candle-power is excessive, the fact is indicated by the display of a red lamp. The lamps are perfectly steady, and are maintained at a somewhat greater candle-power than the majority of incandescent lamps in England. The success of this practical trial of the system is now beyond question. * * *

Not less successful is the Edison Isolated Company, an organization for the supply of light to mills and factories, etc., by means of plant on the premises. This company declared an annual dividend at the rate of 10 per cent. during the month of November, and in so doing enjoyed the distinction of being the first electric light company to pay a dividend on the results of electric lighting pure and simple, excluding profits on manufacture or sales of concessions.

The Edison Lamp Company, whose factory is at Newark, in New Jersey, possesses an establishment which is remarkable even in the land of ingenious processes. The Edison lamp passes through more than 200 stages during manufacture, many of which are automatically performed by the agency of electricity. Mr. Edison's mind is stamped on many of these processes, the exquisite simplicity of which alike charms and astonishes. The factory can turn out 10,000 lamps per day, and, according to Mr. Upton, Mr. Edison's co-adjutor in the undertaking, the resources of the factory are immediately capable of considerable extension. At the Edison Machine Works, at Goerck street, New York, the dynamos, large and small, are manufactured. * * *

The factory of Bergmann and Co. is exclusively devoted to the manufacture of switches, fittings, sockets, regulators, and other details of the complete Edison electric light system. Here also the application of electricity as a motive power and lighting agent was manifested in an impressive manner. Mr. Edward H. Johnson, whose name is well known in London, together with Mr. Edison, is continually at work improving the minutiæ of the system. I was shown a simple screw, the sole survivor of 42 separate and discarded models, which had failed to satisfy Mr. Edison's standard of efficiency. Details of the system are separately and constantly subjected to the fierce light of criticism, and continually being brought up to the requirements of the inventor. As an example of American manufacture and administrative power, the following is an instance:—An order to light the Boston Bijou Theatre with 650 lights was completed within 11 days after receipt of the order. The theatre was wired, the boilers and engines were placed in position, the streets excavated, and the special regulating system necessary for subduing the lights on the various circuits on the stage or auditorium not only devised and manufactured in New York, but used in position. The writer was present at the opening of the theatre when Gilbert and Sullivan's

Iolanthe was produced, and all the necessary scenic effects obtained by the use of the Edison light alone. The theatre was better lighted than the Savoy in London, and the regulation of the lamps seemed to be under more immediate control.

During past years Mr. Edison has suffered from injudicious, because premature, revelations of his inventions, and for some time, therefore, he has remained silent whenever pressed for information as to the progress of his inventions. Some months have elapsed since the Edison system was first shown to the English public at the Crystal Palace, and, as is well known, it is in operation at various places. Since then Mr. Edison has, however, not been idle. He has made remarkable discoveries, the effect of which is greatly to increase the efficiency and reduce the cost of the light. Patents for these and other improvements have already been applied for both in England and the States, and the English companies will shortly give a public demonstration of the new inventions. Mr. Edison's knowledge of the conditions of the electric light question in England is complete. To his mind the price of gas in England is the one factor in the problem which requires solution. It is this problem to which he has applied himself with so much success."

ISOLATED PLANT AT BERGMANN & COMPANY'S. The factory of Messrs. Bergmann & Co., manufacturers of appliances for the Edison electric light system, corner 17th street and Avenue B, New York City, is lighted with an isolated plant consisting of one K and one Z dynamo. The factory is equipped for 600 lights, but 300 is the maximum in use at any one time. No gas is used. The dynamos are driven from pulleys on the main shafting of the factory, being thrown in or out of gear by friction clutches attached to the main pulley shafting.

BERLIN. ACADEMY OF FINE ARTS LIGHTED. Mr. Emil Rathenau, now the director of the German Edison Company, has just completed an installation of 153 A lamps, 122 B lamps and ten 32 candle lamps, in the Academy of Fine Arts, Berlin. Three *salons* in this building are now being fitted up for a loan exhibition of paintings and objects d'art, organized to celebrate the silver wedding of the Crown Prince and Princess of Germany. All that is most choice in the art treasures of the palaces and chateaux of Germany is now being brought together in the Academy of Fine Arts as a testimonial offered in celebration of this event, the Crown Prince and Princess having expressed their preference for this form of celebration.

The exhibition was opened by the royal couple in presence of the most distinguished people of Germany on the 24th January, and will remain open two months. A special steam heating apparatus has been put up for the *salons* occupied by the exhibition, and the engine which furnishes light in the evening will furnish steam for this purpose.

The Edison installation consists of (1) two grand electroliers a the entrance on the street, each mounted with five 32 candle lamps; (2) a gigantic model in carved and decorated wood of the Crown of the Crown Prince, in which are placed 50 B lamps, placed just inside the entrance from the street; (3) on the staircase and in the vestibule are four three-lamp brackets and a chandelier with 12 A lamps; (4) in the first *salon* are four "sun-burners" in bronze and crystal, each with 15 A lamps; (5) in the second *salon* are 4 bronze chandeliers, two of which are each mounted with 18 A lamps, and two with 36 B lamps each; (6) a long gallery has five chandeliers, each with 5 A lamps; and (7) a small *salon* furnished in style of Frederick the Great has one crystal chandelier with 8 A lamps.

This installation is made with one Edison K dynamo, run by a Ruston and Proctor engine, and the illumination is paid for at the usual price, though competitors would gladly have paid for the privilege of furnishing light for nothing.

TAMMERFORS, FINLAND. PLANT INCREASED. The plant mentioned in the second and sixth Bulletins was for the large cotton mills of Messrs. Finlayson & Co., at Tammerfors. This plant originally consisted of five Z dynamos with 300 A lamps, but has now

been increased to two K, two Z and one E dynamos and 650 A lamps. The plant is working successfully, the dynamos being run by water power.

MANCHESTER. AMORY MILL PLANT AGAIN. This plant, mentioned in the last Bulletin, is giving entire satisfaction, and we are authorized by Mr. Whitman, Superintendent of the Mill, to state that our light, although he has only 250 lamps in circuit, is saving him on an average $100 a week on his gas bills for corresponding months last year; and that not only are his lamps showing good life generally, but as regards the last lot of lamps sent him a month ago, not one has burned out.

BERLIN. LIGHTING OF THE WILHELMS STRASSE. This installation is for the lighting of the street known as the Wilhelms Strasse—one of the finest in Berlin, and on which are situated the Ministry of Foreign Affairs, the Palaces of Prince Bismark and of Prince George of Prussia, the English Embassy, the Banking House of Landau, the National Bank and other similar edifices. The light was started December 1st, and has given great satisfaction as will be seen by the following extract from the Berlin correspondence of the Paris *Figaro*, published under date of December 13:

"Now 30 candelabra, each one of 3 lamps, diffuse over the asphalte of the wide side-walks of the Wilhelms Strasse, and on the facade of these great houses, the agreeable and steady light of the Edison lamp, which gives an admirable illumination without fatiguing the eyes. The installation is also made in some of the rich houses of Berlin as well as in the street. The Berliners remember, without doubt, the hard words which were addressed to them last year by the Chancellor, when he found himself unable to rebuild entirely his Palace, and they decided to embellish a little the street in which it is situated, probably to make M. de Bismark more friendly, and thus avoid his reproaches."

THE DEATH-CURRENT AND STORAGE BATTERIES. The following letter, which explains itself, appeared in the daily press in

this city, December 27th. It is reprinted here as a matter of general interest :

"SIR :—Mr. Hayes, representing the Brush-Swan Company, printed a card in yesterday's papers pronouncing as "incorrect" certain statements of mine published Saturday morning touching the death-current and storage batteries of the Swan-Brush Company. Public interest in the subject compels me to correct Mr. Hayes and set the matter straight.

The Brush arc light current is well known to be deadly. It has killed people, and will kill whomsoever touches the wires. The wires are strung on poles and are now used for arc lights. Mr. Brush has a storage battery recently shown here in a neat private exhibition at Mr. Hayes's office, which, it is said, will be brought out for sale and public use in a few months. The Brush-Swan Company proposes to put these storage batteries into private houses, and to supply them with currents from these Brush arc light wires. The storage batteries thus charged will in turn, it is said, discharge themselves in a feeble and safe current over other interior wires connected with incandescent lamps for domestic lighting.

My Saturday's statement was that the Brush-Swan Company 'proposes to introduce these high-pressure currents into houses to feed storage batteries.' I believe that statement to be true, and now repeat it. Mr. Hayes might have seen by a more careful reading of my statement that it was not the feeble 40-volt current leading *from*, but the fatal 2,000-volt current leading *to* the storage battery in the house, of which I plainly spoke.

The Edison current is, throughout his entire system, of low pressure, being about one-twentieth the intensity of the Brush current, and is absolutely safe, as thousands of persons know from having freely handled the wires. The Edison system of lighting is meant for interior domestic illumination, and the details in all respects, and especially as regards danger from fire and to the person, have been perfected with that end in view. The Brush system, however, is devised principally for out-door lighting, where the dangerous conductors can usually be kept away from human contact. But it is now proposed to apply this dangerous current to the new business of ordinary domestic illumination.

The Edison Company, as proprietors of an absolutely safe system of domestic illumination, look with deep solicitude upon the possible advent of another system of lighting dependent upon the introduction of death-wires into the inside of a dwelling or in contiguity therewith. The public will be slow in learning to discriminate between different systems of electric lighting. Should the Brush-Swan wires, which have already killed people in the streets, be touched in, or upon a private house, death is certain. It is said, and doubtless truthfully, that the deadly quality of the current is changed by the storage battery, so that whereas the Brush wires feeding the battery are deadly, the other wires leading out from the battery are safe. This mitigates the evil, but

does not cure it. The bad fact remains that the wires leading from the street to the storage battery, wherever located in a house, are death-giving, and these wires, whether passing up or down the outside of the house wall, or up or down the inside, must, before reaching the storage battery, be more or less liable to chances of contact. This danger will be more readily seen if I explain what the storage battery is and where it will be placed.

What then is the Brush storage battery and where will the householder locate it? That battery, as shown here last week, is described as a coffin-shaped box eight feet long, sixteen inches wide and sixteen inches high. This box is filled with lead plates, is of great weight, and must be placed where it can be got at for the purpose of occasional treatment. Every house would need to have its own separate battery, and many customers will require a number of these boxes, varying with the amount of light required. In some cases they may be put in the cellar, in others in a closet with a strong floor, but place them where you will, the wires leading to them carry the death-current. Although every effort be made to keep the covering of these wires unbroken and their location intact, still, innumerable occasions will happen, such as house repairs, &c., by which they will be exposed to contact. Whoever touches those wires—it may be a curious child, a stupid servant, a fireman, a workman engaged in plumbing, carpentering or carrying coal—whoever touches them so as to receive the current will be killed. The public, as I have stated, will not discriminate. If death happens from such contact with electric wires, a storm of indiscriminating public indignation will attack all methods of domestic lighting by electricity. It is for this reason that the Edison Company views with deep alarm the possible advent of the Brush-Swan storage batteries, fed in the manner described by Mr. Brush in recent newspaper articles.

S. B. EATON,

President Edison Electric Light Company.

65 Fifth Avenue, New York City, December 25th."

CONTRACTS CLOSED BY THE WESTERN EDISON LIGHT COMPANY. Since the issue of the 15th Bulletin the following contracts for the installation of Edison plants have been closed by the Western Edison Light Company:

(1). A plant of two K and one L dynamos and 637 A lamps to light Haverly's Theatre, Chicago.

(2). A plant consisting of one L dynamo and 176 A lamps for the Daily News Company, Chicago.

(3). For the Agricultural implement manufactory of Messrs. R. H. & C. M. Avery, Peoria, Ills., a plant of one L dynamo and 142 A lamps.

(4). A plant of one L dynamo and 178 A lamps for the lard works of Messrs. N. K. Fairbanks & Co., at St. Louis, Mo.

(5). One L dynamo and 175 A lamps for the dry goods store of Messrs. Melcalf Bros. & Co., Detroit, Mich.

A LARGE SUGAR REFINERY LIGHTED. An order has been received for a plant consisting of three K and one L dynamos and 900 A lamps, to be installed in the sugar refinery of Messrs. Havemeyer and Elder, at Williamsburgh, N. Y.

ANOTHER STEAMSHIP PLANT. We have received an order from the Oceanic Steamship Company, San Francisco, for a plant of one L dynamo and 150 A lamps, to be installed on one of their steamships now in progress of construction. This steamship, which has not yet been named, is to run between San Francisco and the Sandwich Islands.

SIDNEY, NEW SOUTH WALES. A NEWSPAPER PLANT. The following in an extract from the *Electrician*, London, December 23rd:

"The Sidney Morning Herald office has been illuminated by the Edison Electric Light. In announcing this fact the Herald says: 'The wires at present are distributed only over the composing frames and in the engine room, but enough is seen to fill every one with admiring surprise, shadows being conspicuous by their absence. The difference in the temperature of the composing room, ordinarily very warm, during the time these lamps are burning, is very marked. The order for the fittings was carried out by Mr. H. H. Kingsbury, representing Mr. Edison's interests in New South Wales. The compositors, it may be mentioned, express their admiration of the new light, considering it superior to that to which they have been accustomed.'"

TESTIMONIAL FROM A NEWSPAPER PLANT. The *Standard*, Jackson, Ohio, January 18th, prints the following reply received by a resident of Jackson, from the Business Manager of the *Ohio State Journal*, Columbus, which is at present lighted by an isolated Edison plant. The question of electric lighting is being agitated in Jackson, and the letter was written to the *Journal* for the purpose of ascertaining how our light was liked. The letter is as follows:

"COLUMBUS, O., Dec. 9, 1882.

DEAR SIR: Respecting the Edison Electric Light, I beg to say that we have been using it since February of this year, and it has given the very best sort of satisfaction. It is cheap, easily managed, and perfectly safe. We have thus far used it only on our first floor, but are now arranging with the Edison Co. to extend over our entire premises, and shall then use it wholly in place of gas. We have had no more difficulty in running it than with any other of our machines. We employ no electrician, and our engineer attends to the dynamo for $3.00 per week over his customary salary. Our experiments relative to the comparative cost of the light demonstrates that it is about equal to gas at $1.00 per thousand. Our employés prefer the light much above gas. In short, we regard it as unquestionably the coming light for all purposes. I shall be pleased to furnish you any additional information.

Yours truly,

J. C. BRIGGS, B. M'gr.

DAVIS MACKLEY, ESQ., JACKSON, O."

ERIE ELEVATOR PLANT, JERSEY CITY. This plant, mentioned in the Fourteenth Bulletin, is now in operation. The distribution of the lamps is as follows:

Track floor	50	A	16	candle	lamps.
Outside dock lights	18	"	"	"	"
Offices	11	"	"	"	"
Front passage	3	"	"	"	"
Two fire rooms	6	"	"	"	"
Dynamo room	3	"	"	"	"
Engine room	8	"	"	"	"
Air line outside	4	"	"	"	"

Cluster for lighting yard		7	A	32	candle	lamps.
Elevator shaft		2	B	8	"	"
Belt shaft		4	"	"	"	"
2d or Bin floor		41	A	16	"	"
3d or Scale floor		24	"	"	"	"
		2	A	32	"	"
	and	1	B	8	"	"
4th or Garner floor		15	A	16	"	"
	and	7	B	8	"	"
5th or Machinery floor		22	"	8	"	"
Conveyor floor		10	A	16	"	"
1st floor		6	"	"	"	"
2nd floor		2	"	"	"	"
3d floor		4	"	"	"	"
4th floor		4	"	"	"	"
5th floor		9	"	"	"	"

The wires from the house are connected with the dynamo by about 40 feet of No. 4 Electric Tubes, at the end of which is placed a safety cut-out protecting the whole system in the house. The 18 lights on the dock are on the first floor system, each fixture, passed through the brick wall, being fastened on the inside, and each wire being insulated with rubber tubing the whole length of the fixture.

EDISON LIGHT FIXTURES. BERGMANN'S FACTORY ENLARGED. The large factory originally occupied by the United States Electric Lighting Company for the manufacture of Maxim lamps and dynamos, and purchased from them by Messrs. Bergmann & Co., for a factory for manufacturing house fixtures and appliances for the Edison light, as mentioned in the Thirteenth Bulletin, is now under full operation. About 300 men are at present employed. They are all engaged exclusively in manufacturing

those details pertaining to the Edison light system which are outside of the dynamo, the lamp and the street conductors, namely, such articles as electroliers, brackets, meters, junction boxes, galvanometers, various kinds of testing apparatus, and a variety of other special Edison devices. Messrs. Bergmann & Co. originally arranged to manufacture these articles only for the United States, but from the fact of their being the first in the field, and owing to the rapid spread of the Edison system all over the world, they are now shipping goods to all parts of Europe. They have recently imported from England, and now carry in stock, many unique and costly designs of electroliers and brackets. These are similar to those shown at the Crystal Palace exhibition in connection with the Edison exhibit, by the London makers, Messrs. Verity & Co., of Convent Garden.

The building purchased by Bergmann & Co., from the United States Electric Lighting Company, having proved inadequate to the rapid growth of their business, they have recently erected and put into operation a new brick building, 25 x 100 feet, contiguous to their factory, to be occupied as a brass-foundry annex to their main establishment. By means of this factory they are enabled not only to obtain their castings with promptness but also to secure a better and more suitable article for the requirements of the business.

In their show rooms they are gradually accumulating, in addition to their standard goods, a great variety of fixtures of rare and rich designs. The electric circuits in the building are so arranged that sample fixtures can be illuminated instantly, so as to show the effect produced when lighted. Messrs. Bergmann & Co. will soon issue a new edition of their catalogue, which will contain cuts, with prices of all the latest designs and apparatus now manufactured by them, including some of these imported designs.

MELBOURNE, AUSTRALIA. CAFÉ LIGHTED. The following is an extract from a recent issue of the Melbourne Herald,

and relates to an exhibition of the Edison system in the dining-room of the Café Gunsler, Melbourne:

> "The tables, which were tastefully decorated, held bouquets in each of which an Edison burner was placed, and the effect of the light shining through the petals was singularly beautiful. Two rows of lights, each of 10 burners, hung against the mirrors at the sides of the room, and two festoons of flowers, each holding 10 burners, crossed the room at either end of the tables. A cluster of 5 burners surrounded each of the ordinary chandeliers. Thus there were 50 lights in all, the result being a blaze of light which, had it been created by the combustion of gas, would have been absolutely unbearable."

EDISON PLANTS IN EUROPE. The last two Bulletins contained an itemized list of all the isolated plants in the United States. They numbered up to the date of the last Bulletin, December 20th, 153 plants, aggregating 29,192 lamps. Since the last Bulletin we have received from Paris a list of all the plants installed and in progress of installation in Europe. It is as follows:

FRANCE.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Compagnie de l'Ouest	Paris	R. R. Station	121
Magasins du Bon Marché	"	Stores	500
Magasins du Louvre	"	Stores	60
Banque de France	"	Bank	93
H. Pochet	"	Glass Works	24
Loddé Fils	"	Feathers	80
A. Lahure	"	Printer	60
Hachette & Cie	"	Publishers	60
Hôtel Continentale	"	Hotel	60
Ph. Bazin	Coudé Moireau	Thread Works	73
Ch. Colliard	Au Câteau	Weaving	120
Poudrerie de St. Chamas	St. Chamas	Powder Mill	60
Exposition de Bordeaux	Bordeaux	Exposition	120
J. Bardon & Fils	Perpignan	Paper Mill	60
P. Schmidt & Fils	St. Dié	Hosiery	240
Fenal Frères	Pexonne	Pottery	80
J. Luc	Nancy	Tannery	60
R. Loeffel & Cie	Blainville (Meurthe and Moselle)	Thread Works	75
M. Clerget	Vesoul	Canned Provisions	60
Ed. Lefebvre	Pont-Anthon	Thread Works	60
Lepage & Cie	Louviers	Thread Works	60

FRANCE—Continued.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Hannart Frères	Wasquehal	Dye Works	80
L. Lefebvre	Roubaix	Thread Works	80
Motte & Maillassoux	Roubaix	Dye Works	80
A. Laroche, Joubert & Motteau	Angoulême	Machine Shops	60
P. Dandicolle Fils & Gaudin	Bordeaux	Merchants	60
Conseil Municipal	Paris		60
M. Chaveau	Toulouse	Café	80
Ch. Sabertie	Mazamet	Merchant	60
B. Sirven	Toulouse	Paper Factory	17
G. Gerbaud	Narbonne	Merchant	17
Belle Jardinieré	Paris	Stores	60
			2,680

ITALY.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Cavalieri & Franco	Bologne	Mills	34
A. Ponti	Solbiate Busto	Cotton Mill	120
Benigno Crespi	Vaprio	" "	60
Crespi & Co.	Bergamo	" "	120
Giacomo Nissim	Pisa	" "	60
Flle. Cassanello fu Vietro	Pegli	Mill	53
G. Crespi & Co.	Vigevano	Cotton Mill	104
A. M. Crossi		" "	26
Lemmann & Co.	Turin	" "	120
Ecole des Beaux Arts	Rome	Museum	60
Central Station	Milan	Station	5,000
			5,777

GERMANY.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
W. Buxenstein	Berlin	Printer	60
Böhmisches Brauhaus	"	Brewery	120
Ressource	"	Club	50
Union Club	"	Club	225
Schäfer & Hauschner	"	Fixtures	17
Fischer & Seige	Possneck	Thread Works	120
Fürss & Crotogies	Rostock	Saw Mill	34
Norddeutsche Raffinerie	Hambourg	Sugar Refinery	15
N. Rosenfield & Cie	Coepnick	Linoleum Factory	60
Société Strontianit	Ahlen	Mine	60

GERMANY—Continued.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Gazette de Cologne	Cologne	Newspaper	120
George Andres	Kreuznach		17
Durkopp & Cie	Bielefeld	Machine Shop	29
W. Schroeder & Cie	Crefeld	Weaving	34
Maier Loewi Frères	Passau		21
William Vogel	Munich	Restaurant	84
Ch. de fer Alsace Lorraine	Strasbourg	R. R. Station	60
Emil Ascherberg	Dresden	Piano Factory	250
Hof Théâtre	Dresden	Theatre	60
Konigl Residenz Théâtre	Munich	Theatre	500
Exposition Munich	Munich	Exposition	800
Von der Heydt	Elberfeld		120
Chantier Impérial	Dantzig	Dock Yard	200
Gouvy Frères	Homburg		60
Ges. für Electric Light	Cologne		154
Roschke & Buchskiel	Zittau		17
M. Moehring	Francfort		120
Rue Wilhelm	Berlin	Street Lighting	250
			3,667

HOLLAND

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
A. W. Krasnapolsky	Amsterdam	Cafe	70
Y. Reynvaan	"	Flour Mill	78
Central Station	"	Station	500
Central Station	Rotterdam	"	1,000
			1,648

AUSTRIA.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Union Rau Gesellschaft	Vienne	Restaurant	350
Théâtre de Brünn	Brünn	Theatre	860
Cte. St. Genois	Czelleckowitz	Sugar Refinery	120
Cie. Fives Lille	Neusatz	Bridge Builders	12
I. Huckels Sohne	Neutischem	Hat Factory	80
Schoeller & Cie	Czakawiz	Sugar Refinery	17
F. de Puskas	Pest	Agency	285
			1,724

RUSSIA.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Finlayson & Cie.	Tammerfors	Thread Works	650
Hutcheson & Cie.	Moscow	" "	310
Ch. de fer Koursk Kieff	Konotop	R. R. Station	120
Alferaki & Cie.	Taganrog	Mill	80
Ingerois & Cie.	Ingerais, Finland	Paper Factory	60
Kaukas, Mercure & Cie.	Sur la Volga	Steamer	80
M. Riecks	Helsingfors	Paper Factory	60
Invasculae & Cie.	Invaculae, Finland	Mill	17
Dembitzky & Cie.	Okoulooki	Bag Factory	60
M. Tanacz	Yosefor	Sugar Refinery	140
M. Nobel	Helsingfors	Forge	120
M. Lentovsky	Nischni Novgorod	Theatre	60
Station Centrale	St. Petersbourg	Station	1,000
Mr. Johnson	Yväskyla	Saw Mill	15
			2,772

BELGIUM.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Béliard & Best	Anvers	Forge	31
Chambre des Députies	Bruxelles		120
Société La Lys	Ghent	Thread Works	60
De Smet & d'Hanis	"	" "	60
M. Rey ainé	"	" "	60
E. L. Godin & Fils	Huy	Factory	60
N. Porta & Cie.	"	Smelters	60
Iwan Simonis	Verviers	Thread Works	120
Sté Anonyme Niel on Ruppel	Anvers	Factory	34
Charbonnage du Presles	Farciennes	Coal Mine	60
Théâtre du Parc	Bruxelles	Theatre	500
Musée du Nord	"	Museum	100
			1,268

SUMMARY.

COUNTRY.	INSTALLATIONS.	LAMPS.
France	32	2,680
Italy	11	5,777
Germany	28	3,667
Holland	4	1,648
Austria	7	1,724
Russia	14	2,772
Belgium	12	1,268
Total	108	19,536

MR. EDISON ON STORAGE BATTERIES. The Boston *Herald*, January 28th, contained a lengthy interview with Mr. Edison on electric lighting generally. He spoke of storage batteries as follows:

"'Mr. Edison,' said the writer, 'what is your opinion of the utility and value of storage batteries?"

'The storage battery is, in my opinion, a catch-penny, a sensation, a mechanism for swindling by stocking companies.'

'Do you wish me to repeat in print that expression?'

'Certainly I do, and it is the truth. The storage battery is one of those peculiar things which appeal to the imagination, and no more perfect thing could be desired by stock swindlers than that very self-same thing. In 1879 I took up that question, and devised a system of placing storage batteries in houses connected to mains and charging them in the day time, to be discharged in the evening and night to run incandescent lamps. I had the thing patented in 1879 (I forget the date of the patent), but there is nothing in it. I rung all the changes on it. My plates were prepared like Plante's. The method of preparing them for charging is more tedious, but it is better than that of Faure, after preparation. You know the first storage battery was sent from France by Faure to Sir William Thompson, who was at first astounded by it. He was asked to indorse it, consented and took a retainer; but on investigation he became convinced that there was nothing in it, and returned the retainer to the French company. The fact is, the more he investigated the more he found out the fallacy of the whole business.

'On account of what Labouchère calls a swindle, this secondary battery has been used by the arc companies in England. One company alone, on the strength of an accumulator and an incandescent lamp, copied from mine by one George Lane-Fox, floated subsidiary companies, whose aggregate capital was over $30,000,000, and immense sums were paid by these companies to the parent company for rights. Within the last few months the bubble has burst, the shares upon which $25 have been paid, are offered at $1, and the swindling companies have been sued for making misrepresentations in their prospectuses as to the value of the accumulator and the right in the incandescent lamp of Mr. Fox, it appearing, from the proceedings before Mr. Justice Chitty, that another company had the right to the lamp, and this company had acknowledged that it was a piracy of the Edison lamp, and were paying royalty to the Edison company for the right to use. The action before Justice Chitty was by a stockholder in a subsidiary company to cause the return of his subscription on the above account. The judgment was in his favor.'

'But cannot electricity be stored?'

'Yes. Scientifically the thing is all right, but commercially as absolute a failure as one can imagine. You can store it and hold it; but it is gradually lost, and will all go in time. Its efficiency, after a certain number of

charges have been sustained, begins to diminish, and its capacity and efficiency both diminish after a certain time in use, necessitating an increased number of batteries to maintain a constant output. Owing to corrosion of the sustaining plates of the battery, the effect of local action and other causes, too many to enumerate, the yearly depreciation of the battery is not less than 30 per cent. of its first cost, if used daily.

'The facts are, that there are two or three companies that have been organizing subsidiary arc light companies throughout this country for some time past. In this arrangement the parent company made money by selling machinery, etc., to the working companies, but the latter are not making money and have nearly ceased giving new orders. Now these parent companies, finding the call for machinery slacking, have come in with their secondary batteries. They now make this statement, which is the cleverest thing I ever heard of: "Here, gentlemen, you have a large investment in machinery, etc., for furnishing light, but are not making any money out of it. Now, we have something by which you can utilize your machinery. You can work day and night, and can do more work. You can utilize your present plant in the day time, and the electricity thus made in the day time for incandescent lighting, and in the night have your plant for arc lighting direct." That sounds good and fair, does it not? The board of directors discuss the offer and think it a good thing. Then they conclude to go into it.

'I will tell you where the fallacy in this arrangement lies. It consists in the fact that the cost of batteries to store this extra electricity that could be produced in the day time would be twice as much as that of the station that produced it; so that, if the company has already $100,000 invested, and agree to utilize their machinery in the day time by the addition of storage batteries, they will find that to carry out their desire it will cost them $200,000 for the batteries. I will guarantee that not one board of directors in a hundred will see it, and the parent company will not tell them of it until after they have purchased.

Well, they have purchased the storage batteries, of course, at a cost of $200,000. On that investment, at the end of the first year, they have a depreciation of 30 per cent. To save themselves they will have to earn interest on their investment. They must also earn enough to meet the extra depreciation on their plant running through the day, and will have to spend double the amount in coal to obtain the same output from the batteries, for the reason that they interpose between the source of energy and the light, a thing in which there is a loss both in charging and discharging, and a loss in standing, and that loss increases as the battery gets older, after a certain maximum is reached.'

'What is the maximum of a storage battery?'

'It is about 50 per cent. You get the maximum of current when you utilize the full capacity of the battery, the same as in a steam engine, where, if steam is admitted for the full stroke, 50 per cent. of the steam or power is wasted,

but you obtain the maximum power from the engine; but this is also the minimum of economy. Hence, to get the proper economy, engine builders only take one-third to one-fourth of the maximum power from their engines, but this adds to the investment, which is compensated for by the saving in economy, which more than pays interest on increased investment.

When they say that 90 per cent. is obtained from the battery they tell you what is scientifically true. They say they get 10 lights of 16 candles each per horse power of current from a battery. Now that is true, and it is not true. If you get a horse power of current from a battery it will give you 10 lights of 16 candles; but to get that you have to net all losses through the battery, through the wires, through the dynamo, and all that. They start off with a horse power indicated in the engine. A certain amount of this is taken to move the engine and dynamo, and a certain amount is lost in the dynamo to convert power into electricity, because no machine is perfect; a certain amount must be lost on the wire connecting the station with the secondary battery; nother amount is lost in charging the battery, due to its resistance and imper- :ction as a mechanism; another amount is lost during the interim between charging and use; another portion will be lost in discharging the battery through the lamps, and still another amount will be lost in the wire connecting the battery to the lamp. So that your horse power will dwindle down until it will give you only about three lamps; whereas, if you worked direct, you would probably get six lamps.'

'You are hard on the battery folks.'

'The reason I am down on these people is because I have a legitimate thing, and there is a loss of public confidence in it through their operations. We have never yet asked the public for money. Now, I don't want the people swindled, for I want our company to make money out of electric lighting in a legitimate way, by giving value for what is received, and, if it sells rights, to first prove to the purchasers their value by results obtained in actual practice upon a large commercial scale, as is now being done, and the exposure of such things would make it much easier and better for me to advance my system on its true merits.

The same swindle which it is designed to perpetrate upon the people of this country has already been carried out in England, and as a result people there have lost all confidence in electric lighting. The same people are here. They have what they call the Swan lamp, a palpable infringement on mine. We have entered suits against them in England, and will sue them here. But these people know well that it will take some time to get a suit decided, and by that time they will have 'permitted the public to invest heavily.'

'Then you consider storage batteries wholly impracticable? Is there no hope for their doing good, legitimate work?'

'None whatever. Except in a very limited number of cases, storage of gas could be made analogous to storage of electricity. One of the principal outlays of a gas company is for pipes. The average diameter of their mains is

five or six inches. But, under pressure greater than they now force the gas through their mains, an inch pipe would answer under the storage principle of having a small gasometer in every house. The difference saved to the company by this arrangement would be about $15 for pipes from house to house, 25 to 30 feet apart. But the gasometer would cost a great deal more in each house than the 25 feet of pipe buried in the street. Besides, gasometers might not be just the thing in the hands of the public; there might be explosions; some of them might not have the room. The gasometer would require some little mechanism to reduce the pressure down to a limit where it could be burnt. Now, these little mechanisms are uncertain.

The general intelligence of the public, when applied to mechanism, is also uncertain; and this has probably prevented gas engineers from introducing a system of local storage. The electric arc company, which is seeking to introduce a system of storage, follow out the above idea exactly. Instead of using large conductors and low pressure electricity, as I do, they propose to save on the investment by using small conductors and high pressure electricity; and, to make this kind of electricity available, they reduce its pressure by means of a storage battery in the same way as high pressure gas in a small main could be stored in a gasometer and its pressure reduced to make it available. In the first place, the high pressure current is very dangerous to life. The depreciation on storage batteries alone, in a system of general distribution, would pay the interest on the extra copper sufficient to dispense with their use; and second, if these small wires carrying high pressure currents were to be placed underground, as all systems must be to be financially permanent in large cities, the extra cost of the insulation necessary to prevent the leakage of the currents of so powerful a pressure would more than pay for the extra copper used in a system which carry low pressure currents, and do not require so expensive nor so great an amount of insulation. The cost of our mains is about $15.00 from house to house. These mains are two feet underground, where the intellectual portion of the public cannot reach it to improve it, while, with storage batteries, from $75 to $200 worth of batteries would be placed in each house to save about $9.00 in copper and interpose an uncertain device in which 50 per cent. of the article to be sold is lost." Mr. Edison here paused a moment, held down his head, and, quickly raising it again, said, in his quaint way: 'Just as soon as a man gets working on the secondary battery it brings out his latent capacity for lying.'

'But suppose power was cheap, such as a water power, would it not pay to store electricity even at a great sacrifice of energy?'

'In utilizing water power, even where the cost of water is, say nearly nothing, there is still the cost of plant for storing to be considered, and interest and depreciation added. Where is the use of this outlay when, in nearly every case, by connecting the dynamo direct with the turbine you can get the same result far more cheaply? But you will remember that water power is not so cheap after all. It it only occasionally you can run across a water

power that has a surplus in every month in the year beyond the wants of those who utilize it. These storage men will tell you that lamps burn better fed from batteries than from the source of power direct. This is not so. They are very brilliant when they start, but more battery must be put on from time to time, or they will soon go down. If you have a battery that will run 10 lights, and wish to run them until 10 o'clock P. M., you must have other batteries to reënforce it, or the lamps will diminish in candle power before the expiration of the time it is rated for. Then, after turning off the lights, the batteries will lose about one-fifth of the charge remaining in them before being recharged.'

'There is a natural law working against the storage battery, and that is that finely divided lead decomposes water. It is stated that when Sir William Thompson had his attention called to this fact he threw up the sponge. All metals are fuel. When oxidized they are ashes, and it takes energy to put them back again into a metallic form, when it is again fuel. Mr. Brush may say he has a secret compound. It is nothing more than a salt of lead. They use lead, and their battery is nothing more than a Faure battery, plain and simple. They say they cannot furnish these batteries for six months. There are shops in this city that can turn out 6000 of their cells within three weeks. The parent Brush Company is a respectable and responsible organization, but the Brush-Swan Storage Company seems to be a corporation for shifting responsibilities from the Brush parent company.'

Mr. Edison here took up a paper and read some extracts from an article about the Brush-Swan Electric Light Company. Commenting on it, he said, among other things: 'I believe there is a society for the prevention of cruelty to animals, and another for the prevention of cruelty to children. Now they ought to get up a society to prevent people making fools of themselves. The receiving of money for such articles as these [referring to the one he was reading] ought to be made an offence at law, for, if it is not a form of obtaining money by false pretences, I do not know what is.'

'Now we will return to the storage battery once more and compare its cost and results with those of the direct system. According to M. Tresca's recent experiments with a Faure battery at the Conservatoire des Artes et Metiers, Paris, under the most favorable conditions, it was found that it gave only 50 per cent. from the dynamo and 45 per cent. from the engine. This battery, which run 11 lamps for 11 hours, weighed 2,310 pounds. This gives 190 pounds of battery per 10 lamps per hour. If this battery is saleable at 35 cents per pound, the cost for battery for 10 lamps per hour is $66.50, or $6.65 for one lamp per hour. For 250 lights for one hour the cost of battery is, therefore, $1,662.50, and for six hours, $9,975. That is, a battery to operate 250 lamps for six hours costs $9,975.

Depreciation 25 per cent	$2,493 75
Interest, 8 per cent	798 00

As the statement is 10 lamps per horse power for the storage cells, they develop 25 horse power; but as 50 per cent. of the energy developed by the engine is all that is returned by battery, 37.5 horse power was required during the 8 hours of charging. A total of 300 horse power is developed by the engine at 4 pounds of coal per horse power—a total of 1,200 pounds per day, or of 180 tons a year counting 300 days, at $4.50 per ton.............	810 00
Investment of $3,000 for dynamo with which to charge the cells, and 10 per cent. annual interest and depreciation..	300 00
Total annual expense *without* cost of dynamo and batteries.	$4,401 75

'There, you have the annual cost by the battery for running 250 lights six hours per day for 300 days. You will observe that only interest and depreciation of plant and actual cost of fuel are charged. Let us now compare the same service by the direct system, throwing in the cost of the dynamo, and see what result we shall obtain:

Cost of dynamo....................................	$3,000
Interest and depreciation 10 per cent...................	300
To run this dynamo to supply lamps direct, will require 35 horse power, and, for six hours, a total of 210 hour horse power. Allowing, as in the other case, 4 pounds of coal per horse power, would give a consumption of 840 pounds of coal per day, and for 300 days, 252,000 pounds, or 126 tons per annum, at $4.50 per ton.......	567
Total annual expense, $867, and, *including* cost of dynamo, it would still be but.................................	$3,867

or $534.75, less than the simple cost of doing the same service by the battery system. If we count the cost of dynamo and battery of the indirect system we have $12,975 for plant, as against our $3000 by the direct system. Have I made the matter plain to you? These are the people who proclaim in flashy circulars that they can light cotton mills an hour or two a day by putting in a little dynamo to run eight hours, store up the electricity produced, and thus save the cost of an expensive plant to run the direct lights. The battery people will probably state that the cost of the battery given by me is excessive; that they will agree to sell them for much less, and will, probably, actually do so, as was done in England with the Lane Fox lamp, which was sold in quantity to the subsidiary companies for 5 shillings, while they cost 12 shillings to manufacture.'

Mr. Edison then went into calculations for smaller plants, but, as his figures would only confirm what he has just given, the writer thinks he need not repeat them."

DANGERS FROM GAS. On August 12th, last, Giovanni Romanelli and Angelo Lamfine were found in their bedroom at No. 71 James Street, New York City, unconscious, having been overcome by escaping gas, with which the room was filled * * *. About August 10th, last, a serious explosion was caused by seeking for an escape of gas with a light. It occurred at 194 High Street, Borough, London, England, on the premises of T. Leftwich. Two women were severely burned upon the faces. The house was damaged by fire, explosion and breakage * * *. On September 18th a Preakness farmer, named Andrew H. Van Riper, was nearly suffocated to death by blowing out the gas on going to bed in a hotel at Paterson, N. J. * * *. A gas machine on the property of Charles Richardson, at Chelten Hills, Pa., blew up October 3d, wrecking the gas-house, and dangerously burning James Mc Ainch, the workman * * *. William Donovan was badly burned about the head by the explosion of gas, October 20th, in a man-hole of the New York Steam Heating Company's pipe system at Cedar and William Streets * * *. On October 21st, Mr. Joseph A. Stafford, of Queen Anne's County, was found in bed in an unconscious condition in his room at Desch's Hotel, South Broadway, Baltimore, from the effects of inhaling gas, which, it is supposed, he blew out instead of turning off * * *. A gas pipe caught fire in the oyster and packing house of Moore & Brady, foot of Montgomery Street, South Baltimore, on October 25th. The flames were extinguished by employees, who shut the gas off at the meter * * *. On October 26th, while workmen were engaged in searching for a leak in the gas pipes in an upstairs' room in the new building of the First National Bank, Hagerstown, Md., an explosion took place, setting fire to the building and badly shattering the walls of several of the rooms * * *. A fire broke out October 28th, in the fruit store of John Fisher, in the basement of No. 791 Eighth Avenue, New York. While the firemen were trying to discover the origin of the

flames, there was a sudden escape of gas from the service pipe in the basement, and several of the men were nearly suffocated * * *. Jeremiah Shaughnessy, of 217 Mott Street, and Michael Farrell, of 1334 Third Avenue, were burned in the face and hands, November 16th, by the explosion of gas in a sewer main, which they were repairing at the corner of Park Place and Greenwich Street * * *. On November 17th, William Toland was stopping at the Washburn House, Batavia, N. Y. A chambermaid passing through the hallway noticed a strong smell of gas coming from Toland's room. He was aroused and seemed to be very little effected. Later in the day, however, the poison he had inhaled made him quite ill, and the services of a physician were called into requisition * * *. A stranger, who gave his name as R. Petri, took a room at the Summit Hotel, No. 65 Bowery, N, Y., November 19th, and late in the evening he was found unconscious in his room, having turned on the gas and allowed it to escape full pressure until it filled the room * * *. John Mc Grogan, foreman, in the employ of the American Steam Heating Co., was burned on the face and hands, November 19th, by an explosion of gas in the man-hole at Nassau and John Streets. He had a torch in his hand, and gas was leaking from the gas main. The hair and beard of Michael Gilroy, who was with him, were singed * * *. On November 26, an explosion, caused by escaping gas, occurred at the cotton spinning establishment of Messrs. Ormrod & Hardcastle, at Bolton, England. Some damage was done by fire and explosion, and four workmen were slightly burned about their faces * * *. On December 19th, a fire occurred in the store of I. P. Lovell & Sons, of Boston. It was caused by an explosion of gas in the basement. Two persons were badly injured, and the loss was $135,000 * * *. On December 5th, an explosion, caused by escaping gas in the basement of the four-story brick building on the southwest corner of Grand and Christie Streets, N. Y. City, resulted in the loss by fire and water of $25,000 * * *. On De-

cember 19th, William Latis and his wife were found dead in bed, in Court Street, Rochester, N. Y., having been suffocated by escaping gas * * *. James Walker, of Chicago, Ills., was found in his room in the Occidental Hotel, N. Y., in an unconscious condition, the room being filled with escaping gas * * *. On December 25th, a fire, caused by a gas jet in the show window of Jacob Beestoffs, Brooklyn, N. Y., resulted in a loss of $3,000 * * *. December 26th, some goods in the window of Z. Epstein, 963 Third Avenue, N. Y., caught fire from the gas, and set fire to the store. The loss amounted to $2.800 * * *. A slight fire, caused by looking for a leak in the gas pipe with a lighted candle, occurred at the store of Peter Hull, 552 Myrtle Avenue, Brooklyn, N. Y., December 26th * * *. Gas set fire to some Christmas greens in the house of Lena Salter, 175 Christie Street, N. Y., causing an alarm of fire. No damage was done, however * * *. On December 28th, a fire, resulting in a loss of $4,000, was caused in the building of Max Miller, 429 Hudson Avenue, Brooklyn, by workmen carelessly handling varnish near a gas-light * * *. A slight fire occurred January 2d, at No. 167 West 34th Street, New York City, by the window curtains catching fire from a gas jet * * *. On January 3d, a fire occurred in the printing office of E. Bridgeman, 88 Warren Street, New York City, doing damage to the extent of $4,000. The cause was the catching fire of a shelf from a gas jet * * *. A fire, doing damage to the extent of $100 in the residence of Col. Chas. H. Taylor, 108 Charles Street, Boston, Mass., was the result of a window curtain catching fire from a gas jet, January 3d. * * *. A window curtain caught fire from gas in the top floor of No. 113 East 25th Street, New York City, January 10th, and caused a fire resulting in a loss of $500 * * *. A fire was caused in the clothing establishment of Whittlesey & Co., Hartford, Conn., January 3d, by an explosion of gas. Damage was done by the fire to the extent of $1,000 * * *. A slight fire occurred January 15th, at 241 East 75th Street, New

York City, by a Christmas tree catching fire from a gas jet * * *. A gas jet at No. 4 Warren Street, New York City, set fire to some wood-work, January 15th, and caused a small fire * * *. A defective gas-pipe caused a fire at No. 5 Avenue A, New York City, on January 16th * * *. A fire, causing a loss of $2,500, was the result of a window curtain coming in contact with a lighted gas jet at the dwelling of Mrs. C. N. Humphrey, Hartford, Conn., January 14th * * *. Escaping gas resulted in a slight fire in the basement of the Merchants' Insurance Company's building, Newark, N. J., January 20th * * *. A window curtain, in the house of Oscar Bennett, 253 Mulberry Street, Newark, N. J. came in contact with a lighted gas jet on January 20th. The result was a fire and loss of $100 * * *. A fire was caused in the St. Louis Hotel, Duluth, Minn., January 15th, by an overflow of gas * * *. On January 23d, at 45 Nassau Street, Brooklyn, N. Y., a window curtain came in contact with a lighted gas jet, causing a fire and damage to the amount of $200 * * *. A man named Fernowsky was found in bed insensible, at a hotel, No. 30 Bowery, New York City, January 26th the room being filled with gas which was escaping from a defective pipe. He was removed to a hospital, where he subsequently died * * *. The gas in the lower section of Pawtucket, R. I., went out about 12.30 A. M., December 20th, and left that part of the town in darkness, causing a great deal of inconvenience as well as danger from escaping gas.

No. 17.
APRIL 6, 1883.

SEVENTEENTH BULLETIN.

The Edison Electric Light Company,

65 FIFTH AVENUE, NEW YORK.

April 6th, 1883.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

CONTENTS.

FIRST DISTRICT, NEW YORK CITY. This plant still runs with unvarying success. It has now been in operation seven months, without stopping one moment, day or night. Not only are our customers satisfied and pay their bills, but the demand for the light bids fair to soon exceed our capacity to supply it. That fact enables us now to pick our customers, and we have already begun to apply the rule of taking only those who use the light for many consecutive hours, say the greater part of all day or all night.

Inquiries are frequently made for a list of customers using our light in the First District. We are at present lighting 368 houses, wired for 8,117 lamps, and a complete list can be seen at any time at our office. The following is a partial list of some of our prominent customers:

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Kidder, Peabody & Co.	1 Nassau Street	Bankers	40
Fisk & Hatch	5 " "	"	54
Continental Bank	5 " "	"	43
Vermilye & Co.	18 " "	"	21
Third National Bank	22 " "	"	50
Winslow, Lanier & Co.	26 " "	"	29
John H. Meeker	84 " "	Engravings	16
Jas. Leach	86 " "	Stationer	17
Union Building	52 William Street		33
Max Jacoby	106 " "	Engravings	11
Alexander Agar	110 " "	Stationer	10
A. S. Barnes & Co.	111 " "	Publishers	14
Samuel Raynor & Co.	117 " "	Envelopes	23
Wm. Tate & Co.	146 " "	Engravings	17
Lehn & Fink	160 " "	Drugs	15
Morris Tasker & Co.	15 Gold Street	Steam Fittings	16
Washburn & Moen Co.	16 Cliff Street		29
Ansonia Brass & Copper Co.	19 " "		68
Creque, Ronalds & Co	60 " "	Plumbers' Materials	21
Richard Koll	164 Pearl Street	Restaurant	51
Wadsworth, Martinez & Longman	207 " "	Oils	19
P. W. Engs & Sons	131 Front Street	Wholesale Liquors	7
McCoy & Labrie	91 South Street	" "	16
Drexel, Morgan & Co.	23 Wall Street	Bankers	106
Commercial Union Assurance Co.	37 " "		26
U. S. Assay Office	34 " "		34
Great Western Insurance Co.	50 " "		14
H. & C. L. Despard	60 " "		7

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
National Fire Insurance Co	60 Wall Street		3
Knickerbocker Insurance Co	64 " "		6
Howard Insurance Co	66 " "		17
New York Insurance Co	72 " "		6
Chase & Higginson	24 Pine Street	Bankers	13
Post, Martin & Co	36 " "	"	7
Sondheim, Alsberg & Co	56 Maiden Lane	Paints	20
Parke, Davis & Co	60 " "	Drugs	23
Shannon, Miller & Crane	46 " "	Military Goods	29
Motley & Sterling	86 John Street	Railway Supplies	15
W. C. Duyckinck	50 " "	" "	17
Edward Barr	78 " "	" "	33
Moore & Warren	57 " "	Printers	13
Dingfelder & Libko	39 Fulton Street	Segars	15
Hanlon & Goodman	57 " "	Brushes	12
H. B. Kirk & Co	69 " "	Grocer	13
Silleck & Co	98 " "	Furnishing Goods	73
Mark Mayer	100 " "	" "	67
E. Goldbacher	98 " "	Optician	10
D. Jacobs	114 " "	Tailor	24
S. Bowman	116 " "	"	29
F. W. Devoe & Co	101 " "	Paints	46
Kueffell & Esser	127 " "	Drawing Materials	12
Marshall Lefferts	90 Beekman Street	Iron	12
New York News Co	20 " "	Newspaper, Books, etc.	10
McGowan & Slipper	30 " "	Printers	14
New York *Times*		Daily Newspaper	242
Truth	8 Spruce Street	" "	13
F. N. Burke & Co	7 Platt Street	Oils	12
Seabury & Johnson	23 " "	Drugs	21
Pancoast & Rogers	28 " "	Steam Fittings	15
New Haven Steamboat Co	Pier 23 E. R.		43
D. H. Houghtaling & Co	142 Front Street	Teas	41
Manhattan R. R. Co	Fulton St. Station		23
E. Blackford	Fulton Market	Fish	19

We are now engaged in equipping additional buildings, among which are the following:

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Brown Bros & Co	59 Wall St	Bankers	49
Chas. Unger & Co	54 Wall St	"	8
Western Union Telegraph Co	195 Broadway		255
N. British & Mercantile Ins. Co	54 William St		50
New York Stock Exchange			300
Satterlee, Bostwick & Martin	55 Cedar St	Insurance	16
Mail and Express	Park Row	Daily Newspaper	45
Commercial Advertiser	Fulton & Nassau Sts.	" "	86

VILLAGE LIGHTING. PLANT AT ROSELLE, NEW JERSEY. We have installed a Central Station plant at Roselle, N. J., being the first "Village Plant" installed. The conductors, the largest being No. 00 wire, and the smallest No. 18 wire, are suspended on poles 30 feet in height, and 130 feet apart, the positive wires, where there are more than two, being on the upper arms, and the negative wires on the lower. Where there are only two mains, the positive is carried on the right going from the Station, and the negative on the left. The total length of wire is $8.\frac{76}{100}$ miles. The mains were all completed on January 15th, and on the first test were found to be electrically perfect. The Central Station is located at the corner of First Avenue and Locust Street, Roselle, and occupies nearly a central position in the district lighted, which radiates about one-half mile each way from the Station. The building itself is a frame structure of tasteful design, and measures 39 feet 7 inches by 34 feet 10 inches, in the clear. Internally it is divided into two rooms, namely, the boiler and machinery rooms. The boiler room measures 15¾ by 39½ feet, and the engine room 19 by 39½ feet. The steam is furnished by a 150 horse-power duplex safety boiler, which is entirely enclosed with brickwork. The machinery room has capacity for four K dynamos, each with an independent engine. We have now installed and in use three K dynamos, two of which are run every night. There are up to this date 35 houses, wired for over 500 lights, connected with the system; we also have installed 150 street lamps. Some of these houses and lamps are half a mile from the Station. The platform of the railway depot is lighted by nine lamps in clusters of three each, each of the waiting rooms is lighted by a three-light electrolier, and the telegraph and ticket office is lighted by a portable fixture and a wall bracket. The current was first turned on, January 19th, 1883, since which date the Station has been run every night without a hitch of any kind, the lights being perfectly steady and reliable.

WATERTOWN, NEW YORK. SMALL CENTRAL STATION. An exhibition plant of one Z dynamo, with 60 A lamps, has been installed at Watertown. The Post Office, General Ticket Office, Great North Western Telegraph Company's Office, and the stores of M. E. Conger & Company, J. R. Miller, Dewey & Fairbanks, Wiggins & Goodale, J. C. Streeter & Company, and Van Namee & Company, are lighted from this plant, which is run very satisfactorily by water power.

STUTTGART, GERMANY. DEPOT AND POST OFFICE LIGHTED. An installation of 1,000 lights is now being made to light the depot and Post Office at Stuttgart.

PRAISE FOR THE EDISON LIGHT. The following tribute to the Edison system is taken from an editorial in the *Manufacturers Gazette*, Boston, January 27th:

"Beginning the investigation of electric lighting with no bias towards any one system, with the single aim to ascertain, if possible, which was the best, safest, and most efficient; with wide opportunities for observing the workings of the various systems, having seen the electric lights in streets, hotels, railroad stations, stores, theatres, and other public buildings; having noted the arc and incandescent systems working side by side, as well as separately; having also obtained evidence from parties entirely unconnected with any one of the different electric systems, and after months of personal observation, investigation, and study, we have reached the conclusion that the electric light is the coming light, that the incandescent system is the preferable one, and that the Edison system is so far the best, safest, most efficient, and satisfactory in general, and that for cotton and woolen mills, and other manufacturing establishments, it is the most desirable. It has been abundantly proved that the electric light is a cheaper and better illuminator than gas, and whether considered from an economic or sanitary standpoint, whether from the point of safety or expediency, it is only a question of time when gas, as a general illuminator, shall be relegated to the list of things that were, but which have had their day."

NEW YORK "COMMERCIAL ADVERTISER" TO BE LIGHTED. The offices and composing rooms of this newspaper are to be lighted from the Pearl Street Station as soon as the wiring can be completed. There will be 9 lamps in the offices, and 77 in the composing rooms.

BALTIMORE. JOHNS HOPKINS HOSPITAL TO BE WIRED. We have received an order to wire the Johns Hopkins Hospital, Baltimore, for the Edison light.

STEAMSHIP "ALEMEDA" TO BE LIGHTED. An order has been received from the Oceanic Steamship Company, San Francisco, for a plant of one L and one Z dynamo, 210 A lamps, to be installed on the steamship "Alemeda."

WATERLOO STATION, LONDON. PLANT INCREASED. This plant, which originally consisted of two Z dynamos, has given such satisfaction that it has been increased by the substitution of an L for one of the Z dynamos.

INSTALLATIONS MADE BY THE WESTERN EDISON LIGHT COMPANY. Although this Company has been in existence but a little over six months, its business in isolated plants already amounts to 25 plants, aggregating about 5,000 lamps. The Company informs us that all of these plants are giving entire satisfaction.

RAYS OF INCANDESCENT AND ARC LIGHTS COMPARED. The following extract, from a report made by Mr. L. SKeringer on his experiments in comparing the efficiency of incandescent lights and arc lights, is of interest:

"The rays of the Edison incandescent lamp make a firmer and more lasting impression on the eye, and one more quickly received by the eye, than the rays of the arc light. An analysis of the rays of the two lamps, the Edison and the arc, accounts for this difference. Place Edison lights on the same pole or other support with the arc light, with the Edison light underneath and the arc light over, the former will practically neutralize the rays of the arc light, so that if the eye be suddenly closed, or if one turns suddenly about and faces in another direction, the impression left on the eye is that of the Edison light and not that of the arc light. One experiment made to compare the efficiency of these two systems of lighting, was to place five incandescent lights underneath a cloth canopy with the sides entirely open, in a public building of large dimensions, lighted throughout with arc lights. From every part of the building, both near by and at a distance, the eye was arrested by these few incandescent lamps, and a distinct impression was made by them upon the eye, although their aggregate candle power was insignificant as compared with that of the arc lights. In small rooms the rays of the arc light pierce the eye with more intensity than those of the incandescent light, but the effect upon the eye is ruinous, and practical experience shows that the eyesight is seriously injured by the proximity of the arc light. Consequently the Edison light, although it will impress itself upon the retina of the eye more strongly than the arc light, should not be placed in small rooms, or even rooms of moderate dimensions, along with the arc light. On the other hand, there need be no hesitation in lighting any two adjoining rooms, one with the Edison light and the other with the arc light, for the Edison light will not only give greater satisfaction on account of its superior purity and steadiness, but will make a deeper and more agreeable impression upon the eye. At the Paris Exposition there was a struggle for public favor between the arc and incandescent systems of lighting. The former gradually but surely lost the day, especially on account of the crudity of its glare. The prestige of the arc light was somewhat regained, however, by an invention of Douce & Co., who placed their arc lamps in vases, the light being concealed in the vase, and reflected from a white sheet tightly stretched above it. Enormous candle power was lost by this method, the loss being so great as to make it practically worthless viewed from the stand-point of economy, but the light itself was made, by this device, nearly as moderate, although not as steady, as the incandescent light. It is not for the interest of either the arc light or the incandescent light that they should be placed in the same room, especially if it is one of small or even medium dimensions."

NEW YORK CITY. DAKOTA APARTMENT BUILDING. We have closed a contract with Messrs. James Meehan and James Bunyan, Executors of the estate of the late Edward Clark, for the wiring of the Dakota Apartment Building, now being erected on

Eighth Avenue and Seventy-second Street, for 5,000 A lamps of 16 candle power each. The work is to be done with Edison electric tubes, lead-covered wire, and the ordinary double insulated wire. The wires in the various apartments will be concealed by ornamental mouldings, to be approved by the architect, Mr. H. J. Hardenburg.

MADRID, SPAIN. FACTORY LIGHTED. The machine works of M. Labrador, at Madrid, are lighted with an Edison isolated plant.

STEAMSHIP LIGHTING. SAFETY OF THE EDISON SYSTEM DEMONSTRATED. The steamer "Carolina," which is lighted by an Edison plant, came into collision with the British steamship "Riverdale" about 1.30 A. M., January 30th, while on her way from Norfolk to Baltimore. The "Carolina" sustained considerable damage to her deck, wheel, etc., and the outer row of staterooms on the saloon deck, as well as the sides of several other rooms, were partly carried away, exposing the interiors to the weather. In an interview with a reporter of the Baltimore *Sun*, Captain Whittle of the "Carolina," said: "We had a most satisfactory demonstration of the perfect working of our Edison electric lights, which were only extinguished in the damaged part of the boat, thereby removing all danger of fire, which certainly would have been probable had any other method of lighting been employed."

NEW YORK. MR. VILLARD'S RESIDENCE. The new residence of Mr. Henry Villard, corner of Madison Avenue and Fiftieth Street, New York City, is being wired for the Edison light.

PROGRESS IN CHILE. The Central Station at Santiago is a large, handsome two-story brick building, situated at a distance of 250 feet from the Grand Plaza and business centre. The lower rooms

are for dynamos and engines, steam being generated by boilers located in the yard. The station was opened November 4th, with a capacity of 3 Z dynamos, 1 sixty horse-power boiler, and 1 Armington & Sims engine, and is now being enlarged by the addition of 3 more boilers (2 of sixty horse-power each, and 1 of thirty horse-power), together with 2 additional Armington & Sims engines, intended to supply the motive power for 6 K dynamos. The current is distributed to consumers through 1,500 feet of Edison underground conductors, and an equal quantity of cable. The Station is built with unusual care, the boilers being enclosed in safety walls, and fitted with duplicate safety valves and Bourdon low-water indicators. The feed water for these boilers may be taken from 4 different sources, and may reach the boilers through heaters, pumps or injectors. Smoke is carried away by an iron chimney 85 feet high.

An installation is now being completed at the residence of Madame Consino, Santiago, Chile, which is said to be the handsomest private edifice in South America. Three Z dynamos, with engine capacity for 4, are located in a building erected for the purpose in the garden, 275 feet from the house, the current being taken to the residence, green-house, stables and out-buildings by Edison underground conductors. All the fixtures for this installation have been specially made to order, and are of the finest design and most expensive class.

An installation of one Z dynamo and 60 A lamps is being made at the steamship dock in Lota, in the south of Chile.

The mill San Christobel, Santiago, Chile, is lighted with an Edison isolated plant of 40 A and 40 B lamps. The dynamo is driven by water power. The plant gives satisfaction in every respect.

A plant of one Z dynamo and 60 A lamps has been installed in the flouring mill of Valdez Brothers, Buenes, Chile, to light the mill, the dwelling house of the proprietors and the street leading from the town.

NEW YORK "TRUTH" LIGHTED. We are lighting the press rooms of the New York *Truth* with 13 lamps from the Pearl Street Central Station.

STRASBOURG. DEPOT LIGHTED. An Edison plant has just been installed in the Depot at Strasbourg.

LAKE GEORGE, N. Y. HOTEL TO BE LIGHTED. We have received an order for a plant of 350 A lamps, to light the Green Island Hotel, Lake George.

VIENNA. IMPERIAL PALACE PARTIALLY LIGHTED. The following translation of a paragraph in the Paris *Gaulois*, February 8th, is of interest:

> "Who says that the Edison light was made only to compete with gas? The Court Ball, which took place last Tuesday at the Imperial Palace, at Vienna, where gas was never permitted to be used, was exclusively lighted by the Edison system. It is needless to say that the success was perfect."

The Paris *Figaro*, February 8th, contained a notice of which the following is a translation:

> "At the Court Ball, last Tuesday, the Grand Hall was lighted by 500 Edison lamps. The reflection of the electric light in the brilliant crystals produced a superb effect. Their Majesties were delighted, and announced to everyone their entire satisfaction."

PHILADELPHIA. SUGAR REFINERY PLANT. We are installing a plant consisting of one Z and two L dynamos, 360 A lamps, in the sugar refinery of Messrs. Harrison, Havemeyer & Co., Philadelphia.

ANOTHER NEWSPAPER LIGHTED. BOSTON. We have installed a plant of 173 A lights in the new building of the Boston *Daily Advertiser*.

CUBA. ISOLATED PLANTS. We are informed by Mr. Montamat, the representative of the Edison light in Cuba, that since the last Bulletin he has installed the two following plants:

(1). One Z dynamo, with 59 A and 6 B lamps, in the newspaper offices of the *Diario de la Marina*, the principal newspaper in Havana.

(2). A plant of one Z dynamo, 28 A and 74 B lamps, on the sugar estate "San Joaquin," situated in the Colon Jurisdiction, and belonging to the Count de Casa Ybañez. This is the second Edison plant installed for him. After first trying the system on his "Socorro" estate (mentioned in the Sixteenth Bulletin), he decided to have a similar plant on his "San Joaquin" estate, in place of the arc light, having become convinced that the Edison light is more economical and preferable in every way than the arc or any other artificial light.

PHILADELPHIA, PA. TESTIMONIAL. We have received the following testimonial in regard to the plant now in use in the worsted mills of Messrs. Clark & Keen:

"PHILADELPHIA, Feb. 15th, 1883.

THE EDISON CO. FOR ISOLATED LIGHTING OF NEW YORK,
PHILADELPHIA AGENCY:

GENTLEMEN:—In response to your enquiry, it gives us pleasure to state that the Edison Light plant of 250 lamps you installed for us in the early winter has thus far given us perfect satisfaction. We have a much better light than with gas, which is of vital importance to us in our manufacture of dark goods. Our operatives all like it, especially the night hands, as the air is purer to breathe, and unaccompanied by the drowsy feelings resulting from gas lighting, formerly used in the mill. In addition to this, our saving from the use of electricity on the Edison system, over our gas bills, will in the first year repay the cost of your whole plant.

It gives us pleasure to add that you have fully carried out all that you have promised us.

Yours truly,

CLARK & KEEN."

LOUISVILLE, KENTUCKY. WOOLEN MILL PLANT. We are installing a plant consisting of one K dynamo, and 250 A lights at Louisville, in the mill of the Old Kentucky Woolen Mills.

LHILADELPHIA. SHIP YARD PLANT. We have received an order from Lieut. Commander H. H. Gorringe, or a plant of two L dynamos, and 350 A lamps, to light the ship yards of the American Ship Building Co., at Port Richmond, Philadelphia.

NEW YORK CITY. HAWTHORNE FLATS WIRED. We have just completed the wiring of the Hawthorne Apartment House, at 59th Street between Sixth and Seventh Avenues, for 900 A lamps, an average of 90 lamps per floor. All the wiring is concealed.

VILLAGE PLANT FOR BROCKTON, MASS. The Edison Electric Illuminating Company of Brockton has been organized to light the city of Brockton, from an Edison Central Station, on the Village Plant system. The officers and directors of such company are as follows:

Charles Goddard White, President; William Lloyd Garrison, Treasurer and Clerk; William J. Jenks, Manager; Directors: Charles Goddard White, George P. Denny, C. B. Prescott, James B. Tolman, and F. J. Coburn.

A canvass of the town has been made, an estimate furnished, and an order given to us by the Brockton Company for a Central Station of 4,800 A lights.

THE EDISON EXHIBIT AT MUNICH. The following is an extract from the London *Engineering*:

"At each exhibition of electricity the Edison Company has been conspicuous by the number and varieties of its exhibits, and at Munich it again maintained its reputation by a lavish display of lamps. In a hall situated at the angle

of the palace, beside the telephone cabinets, there were united the complete collections of the different types of apparatus already exhibited at Paris and London. These include, lamps mounted upon various kinds of supports, portable lamps, specimens illustrating the process of manufacture, cables, underground tubes, etc., all of which have been recently described in this journal. In the gallery there were three dynamo machines of the type K, designed to feed either 250 A lamps of 16 candle power each, or 500 B lamps of 9.5 candle power each. These machines ware arranged as follows: Two of them coupled parallel, furnished current to 275 A lamps for the illumination of the auditorium of the theatre, of the stage, and of the actors' boxes, and to 200 B lamps for lighting the entrance to the theatre. The third dynamo lighted the restaurant by 210 B lamps and 22 A lamps; several show rooms containing furniture, by 20 B lamps and 6 A lamps; M. Wegle's exhibition of phonometric instruments, by 16 B lamps and 12 A lamps; the school of design, by 22 A lamps; the reading room, by 19 A lamps; Edison's room, by 72 B lamps and 14 A lamps; the Commissoners' room, by 6 A lamps; the Oberammergau Telephone room, by 1 A lamp; and the cloak room, by 4 A lamps; or in all 318 B lamps and 106 A lamps. Two other machines, type Z, with two electro-magnets each, were employed in the transmission of power, and served to drive domestic apparatus for the manufacture of butter. * * * In the evening one of them, constructed to feed 60 A lamps, or 120 B lamps, effected the lighting of the bar by means of 6 B lamps and 14 A lamps, and of the Rue Axis, by 48 A lamps. These figures show that all these machines were working slightly beyond their normal power. The installation, which comprised a total of 524 B lamps and 543 A lamps, was the work of the Compagnie Edison of Paris, and produced, as might be expected, a very splendid effect."

DETROIT, MICHIGAN. DRY-GOODS STORE PLANT. The following is an extract from the *Evening News*, Detroit, January 29th:

"The introduction of the Edison incandescent light in Detroit was witnessed by a large throng of people on Saturday night at Metcalf Bros. & Co's dry goods store. On Saturday it was put in operation, and from 5 to 10 p. m. the lights were kept burning. There are 88 lamps on the ground floor, and the scene there was quite brilliant, but there was none of the dazzling brilliance of the arc light. The lamps at Metcalf's burned steadily, and without any perceptible variation or flicker, and the macinery seemed to work to a charm."

A BAD FAILURE OF GAS. We take the following paragraph relating to a failure of gas at Halifax, England, from the London *Electrician*, February 10th:

"On the evening of Friday, the 2d inst., a large part of the town of Halifax was suddenly deprived of light owing to a failure in the gas supply. The breakdown is attributed to water having got into one of the mains. Many mills and factories had to stop working, the railway stations were left in darkness, and generally things were uncomfortable in Halifax on Friday evening. Seeing what a vast amount is made by the Journals representing the gas interest out of the occasional failures or breakdowns which occur in electric lighting, we think we may as well draw attention to the fact that gas is by no means infallible, even in a large town, where everything should be in apple-pie order. If we were to refer to every little breakdown in gas lighting in small towns and out-of-the-way places, we should have little room for other matters."

NEW YORK CITY. APARTMENT HOUSE WIRED. We are now wiring the Apartment Building known as One Hundred and Twenty One Madison Avenue, for about 1,200 lights, the work being entirely concealed. The building is 11 stories high, there being an average of 109 lamps per floor.

MILWAUKEE. THE BEST BREWERY PLANT. The following extracts are taken from the *Republican Sentinel*, Milwaukee:

"On Saturday one section of the Edison light installation was started in the buildings of the Phillip Best Brewing Company, and, in about two weeks, 700 Edison globes will be in operation. In malt-house No. 1 there are 270 incandescent lights, and in the office and other buildings, and Frederick Pabst's residence, there are to be 430 additional lights. These are A and B lamps of ten to twenty candle power. The generators are located on the corner of Chestnut and Tenth Streets, in the boiler and engine-room. * * * The dynamo machine is sufficient to furnish currents through the entire system. The revolutions of the armature are 900 per minute, and the total electro-motive force of the machine is equivalent to 110 volts. The underground conductors, of which 300 feet have been laid, were tested in the factory at New York at 150,000,000 ohms, and, after being placed underground, were tested at 20,000 ohms to and fro current, the most severe test that they could be subjected to. In the test, the loss of electricity was nothing. The current used in the underground tubes conveys the electricity from the machine to the different buildings. * * * Each light, and each group of lights are controlled by safety-catches, forming an absolute safe-guard against fire or an overcharge of electricity."

APPLETON. HOTEL TESTIMONIAL. The following letter, from Mr. Cottrill, Waverley House, Appleton, Wis., shows what he thinks of our light:

"WAVERLEY HOUSE, February 15th, 1883.

GEORGE H. BLISS, Esq., Supt.
WESTERN EDISON LIGHT COMPANY,
CHICAGO, Ill.

DEAR SIR:—The Edison Incandescent lamps have been in use in my Hotel since the 16th of January last. The light is much more brilliant, uniform, without odor, also fire-proof, than any gas that ever was manufactured. The convenience and the economy must in time bring this lamp into general use. The lamp is perfect, as there is not the slightest oscillation.

In short, it gives me perfect satisfaction, and you have my warmest wishes for your success.

Yours respectfully,
W. H. COTTRILL."

NEW YORK. WESTERN UNION TELEGRAPH BUILDING LIGHTED. The building of the Western Union Telegraph Company, Dey Street and Broadway, is to be lighted from the Pearl Street Station by a special conductor running down John Street, and connected with the net-work of conductors in the First District, at Nassau Street. The building is being wired for 345 lamps, but for the present only about 255 will be used, distributed somewhat as follows:

Rooms of the Associated Press	55 lamps.
Operating Room	107 "
Second Floor	55 "
Halls	8 "
First Floor, No. 8 Dey Street	15 "
Second Floor, No. 8 Dey Street	15 "
Total,	255

EUROPEAN COMPANY'S THIRD BULLETIN. We have received copies of the Third Bulletin, February 15th, of the Compagnie Continentale Edison, 33 Avenue de l'Opera, Paris. It is a

document of 20 pages, and contains a list of recent installations of isolated plants, and of central stations in progress of being installed, together with interesting information showing the success of the European Company.

DIJÖN, FRANCE. A CENTRAL STATION PLANT. A sma- central station plant, to be composed of K dynamos and Armington & Sims engines, is to be at once installed in Dijön. It will be started with about 1,100 lights, and will be subsequently increased.

PEMBERTON MILL PLANT AGAIN. By permission of Mr. W. L. Garrison, we take the following extracts from a letter written to him by Mr. F. E. Clarke, in reply to an inquiry as to the efficiency and economy of the Edison plant in the Pemberton Mill, Lawrence, Mass:

"We put in one Z dynamo, 65 A or 120 B lights, in October, 1881, and at first tried the 120 B lights with it, lighting 120 looms, with one light to a loom. From what I saw in New York, I became convinced that the A lamp, using half as many, would serve us better, consequently I made the change, getting 65 A lamps in running order in January, 1882. With these A lamps we lighted 130 looms. The many advantages of the light, some of which were—almost perfect condition of the atmosphere when using no gas jets, discrimination of colors, little imperfections in weaving remedied more quickly by the weaver, a better diffusion of light among the machinery, enabling quicker renewing of warps in looms, and quicker repairing of breaks in warps or machinery—all of which were experienced in using the light through the winter of 1881 and 1882, and up to September of 1882—decided me to increase the number of lights so as to light wholly two entire weaving rooms. I therefore contracted for 2 L dynamos, 150 lights each, giving me in all 365 A lights. These were all in operation early in November, 1882, and have been in use continually since. After a week's use I had taken out of the two rooms all of the gas jets except 4 in each room, which are used in case of stopping of electric lights, that no panic may be occasioned among the help. The electric machines are driven by the regular power of the mill (water wheels), and once in a while a short stop is necessary from some breakage of shaft or large belt, etc.; hence, the few gas jets spoken of above. The operation of the machines and lights through the mill thus far have been very satis-

factory. We make colored goods largely. Our weave rooms are wide, and dark days, and in fact, nearly, if not quite, every day we have used a part of the lights all day. The difference in the atmospheric condition of the rooms from what they were when we used gas, is almost indescribable. In the evening, when all lighted, the air is as pure to the health and sight as it is in the full sunlight.

I have the light at my desk in the office, and its steadiness, and the absence of heat rays, make it very pleasant, and I am able to write and read as long as I choose, without any inconvenience to my eyes. • • •

Now for comparative economy of gas and electricity.

We have 365 A lights.

We used during January, 1883, 135 lamps all day (10 hours).

We used during January, 1883, 230 lamps, 2 hours each day, equivalent to 181 lamps all day, 10 hours each day, as we displaced 2 gas jets with each A light, we displaced 362 gas jets.

362 gas jets, 10 hours, 4 feet per hour, gives 14,480 feet gas. 14,480 feet gas, at $1.65 per thousand, = $23.89 as daily cost of gas to obtain a poorer light.

Electric plant cost entire, $6,825.60.

12 per cent. of 6,825.60 for interest and depreciation, one day....................................	$ 2.73
Power eight-tenths of one cent. per H. P. per hour, for 181 lights 28 H. P...........................	2.24
Lamps, 181 lights; renewal 4 lamps daily.........	4.00
Extra cost, man and oil, etc......................	1.25
	$10.22

$10.22 cost daily of 181 lamps 10 hours per day."

NEW YORK. FIRE ENGINE HOUSE LIGHTED. We have installed 22 Edison lamps in Engine House No. 32, located at No. 108 John Street, which will be supplied from the Edison Central Station on Pearl Street. The following ingenious application of the light has been arranged in this installation. Connected with the fire-gong, is an automatic device by which the horses are unhitched simultaneously with the sounding of an alarm, and this same device is made to operate a switch for completing the electric circuit, and so turning on the lights. When, therefore, an alarm is sounded

during the night, the ground floor and the sleeping apartments are instantly lighted automatically, so that the men and the horses have only to jump to their places, thus obviating the necessity of stopping to light up.

WILLIAMSPORT, PA. EXHIBITION PLANT. The following extract from the Williamsport *Daily Sun and Banner*, of March 19th, relates to a small plant installed by the Edison Company of that city for exhibition purposes:

"The announcement that a number of business places would be lighted up on Saturday evening by the new Edison electric light, brought out quite a crowd of people to the vicinity of Market Square. The stores in which the light was exhibited, were those of D. S. Andrus & Co., Beck Bros. & Co., J. T. Little, Lloyd, and the Star Clothing House. The light is far superior to that which has been furnished to some of the business houses during part of the winter; in fact, the latter will bear no comparison to the Edison, which emits a steady mellow light, not the least dazzling, and without any apparent bad effect upon the eyes. About five thousand people must have witnessed the light on Saturday night, and the opinion given here, was the unanimous opinion of the crowd. It is the intention of the Company to make the Edison light a permanent fixture of the city, and will at once proceed to canvass the city for subscribers. They claim that its cost will be little above that of gas, while the superiority of the light should commend it even for domestic purposes. The company is composed of Abram Updegraff, J. J. Crocker, W. H. Sloan, H. C. McCormick, J. C. Hill, James J. Gibson, Dr. B. H. Detwiler, W. L. Parker, J. B. Coryell, William Gibson, J. A. Beeber, and P. B. Shaw."

The extract below is taken from the Williamsport *Daily Gazette and Bulletin*, of the same date:

"The object of the Company in exhibiting the light Saturday night was to show to our citizens the character of the light, and the system under which it is supplied to consumers, its safety, economy, practicability, superior brilliancy and adaptability to domestic purposes, as well as to illustrate its cleanliness, absence of heat and flickering, and all other objectionable features of gas. This purpose was accomplished in the highest degree, as evidenced by the enthusiasm expressed by more than five thousand people who turned out to witness for the first time an incandescent electric light."

ENGLAND. PROGRESS OF THE EDISON LIGHT. Previous Bulletins have contained lists of plants installed in the United States and on the Continent of Europe, aggregating at the date of the last Bulletin 272 plants, 52,586 lamps. Below is a report just received from London, showing also the Edison plants either installed, or in process of installation, by the London Company, and by the Manchester Company:

INSTALLATIONS BY THE LONDON COMPANY.	LAMPS.
Central Station, Holborn Viaduct, London	950
Consolidated Telephone Company, London	120
Robey & Co., Engineers, Lincoln	120
Archibald Coats Esq., Woodside, Paisley, N. B.	130
T. Tayler Smith, Esq., Bush Hill Park, Enfield	65
B. Verity & Sons, Electric Light Fittings, London	65
Waterloo Station, L. & S. W. Railway Co., London	200
City and Guilds of London Technical College, Finsbury, London	200
Holborn Restaurant, London	1,000
Dining rooms and Library of the House of Commons, Westminster	150
S. S. "Tarawera," Union S. S. Co. of New Zealand	150
S. S. "Waihora," " "	150
S. S. "Pateena," Tasmanian Steam Navigation Co.	150
S. S. "Rio Pardo," Brazilian Steamship Co.	65
S. S. "Rio Parana," " "	65
S. S. "Apollo," Compagnie La Plateuse	180
S. S. "Minerva," " "	180
S. S. "Clan Macarthur," Clan Line	150
H. M. S. Troopship "Malabar"	373
	4,463

INSTALLATIONS BY MANCHESTER COMPANY.	
Show-room & Offices, 7, St. Mary's Gate, Manchester	90
Mather & Platt, Engineers, Salford	1,000
D. Moseley & Sons, India Rubber Manufacturers, Manchester	1,000
Wright, Turner & Son, Spinners, Salford	900
George Hopwood, Manufacturer, Birtles Dean	120
Gottschalck & Co., Merchants, Manchester	100
The "Harrison" Patent Steam Steering Co., Salford	70
Theatre Royal, Manchester	500
Manchester "*Guardian*," Editor's & Compositors' rooms	120
Manchester "Royal Institution," Picture Gallery	80
	3,980

EDISON LAMPS USED WITH OTHER DYNAMOS.	
Phillips Bros., Wire Manufacturers, Hackney Wick, near London	130
Society of Arts, London	50
Colonel Gouraud, Little Menlo, Upper Norwood	30
Trafalgar Colliery, Cinderford, Gloucestershire	60

Our light is also used on the express trains of the London, Brighton, and South Coast Railway, and on the fast passenger steamers of the same company to France, the lamps in both cases being fed by Faure accumulators.

SUMMARY.

Lamps installed by London Company	4,463
" " " Manchester Company	3,980
Total	8,443

NEW YORK CITY. MR. TILDEN'S RESIDENCE WIRED. The residence of Hon. Samuel J. Tilden, No. 15 Gramercy Park, has been wired by us for 150 Edison lights, all wires being concealed by ornamental mouldings.

CONTRACTS CLOSED BY WESTERN EDISON LIGHT CO. Since the last Bulletin, the following plants have been sold by the Western Edison Light Company:

(1). A plant of one Z dynamo and 60 A lamps, for lighting the Merchants' National Bank, Chicago.

(2). A plant of one Z dynamo and 60 A lamps, to be installed in the Star and Crescent Flouring Mills.

(3). The plant for the American Express Company's Offices, Chicago, has been increased from one L dynamo, 150 A lights, to one K dynamo and 250 A lights.

A GAS NEWSPAPER ON GAS. ADVERSE CRITICISM. The following is an extract from American correspondence in the London *Journal of Gas Lighting*, December 12th:

"One thing that will operate in Edison's favour, when he gets to work in earnest to light the down-town district, is that this section of the city is supplied with water-gas. This gas gives a great deal of trouble by causing the

burner tips to become stopped up with carbon; the result, of course, being a miserable forked flame. Further, people are beginning to realize that carbonic oxide is not so harmless a substance as they have been led to believe. The truth, is the number of deaths caused by water-gas in New York City alone, during the last few months, is simply appalling. The *Sanitary Engineer* stated that 14 deaths have occurred in the city in consequence of the use of this gas, since the 1st of July. If there is to be a fight between gas and electricity, this is a heavy load for the gas industry to carry to the conflict. A few evenings since a man, and his wife engaged a room in a hotel at two o'clock in the morning. At about nine o'clock a strong odour of gas was perceived in the vicinity of the apartment to which they had been assigned. On bursting open the door the woman was found to be dead, and the man died shortly after he was discovered. Of course it is stated that they blew out the gas—in fact, this is the stereotyped explanation of these disasters; but it seems strange, that a man who had lived in the city for some time (perhaps all his life) would not know better than to blow out a gas flame. The truth is that gas containing a large percentage of carbonic oxide is very liable to be blown out by even an ordinary draught; and these accidents, I think, are not occasioned by people blowing out the gas, but by the flame being extinguished by some current of air blowing through the room. Another case—a policeman in the city—was found in a lodging house in Chatham Street, asphyxiated by gas; death followed shortly after his removal into the open air. Strange that a man so used to the ways of a large city as a policeman must be, should be guilty of such gross stupidity as to blow out the gas. Of course, in the accounts of these accidents which appear in the daily press, no mention is made of the fact that it is water-gas that creates such havoc; and so the whole gas industry has to bear the burden of the sins of our water-gas friends. Nor do the managers of the electric light companies let these opportunities for casting discredit on the gas business pass 'unimproved.' On the contrary, every such accident is graphically described in large type in the Journals devoted to the cause of the new illuminant. So the public are being 'educated' to the belief that gas is a death-dealing substance. * * * Even since penning the above 'Notes,' news has reached me of another accident from water-gas in New York City. A young man from Chicago put up at a down-town hotel last night. This morning he was found in his room alive, but unconscious, with gas escaping from an unlighted burner. He was removed to a hospital, and according to last accounts was alive, though there is little chance of his recovery."

TESTIMONIAL FROM NATIONAL TUBE WORKS. The following letter is from the National Tube Works Company, McKeesport, Pa., in reply to a letter from our Company inquiring if the report was true that our isolated plant was not giving satisfaction

"McKeesport, Pa., Feb. 14th, 1883.

Edison Company for Isolated Lighting,
New York City.

Gentlemen:—I am in receipt of your valued favor of the 8th inst., reporting a story in circulation that the Edison Electric Plant at our Works has not given satisfaction etc., etc.

I have before me the written report of our mechanical engineer, and beg to submit it in answer to the rumor you report:

'In reply to your request for a report on Mr. Clark's letter, I would state that we are using the Edison Light regularly every night, and have been so using it ever since the plant was installed, with the exception of a few weeks during the past summer, when our mills were shut down, owing to the strike among the iron workers. The plant is working to our entire satisfaction. We have in all 65 lamps, but at present are only using one-half that number, because the department in which they are placed, is not running full at this time. Since the resistance box was changed, we have experienced no difficulty whatever in regulating the light according to the number of lamps we wish to use; we run the dynamo direct from our main engine, which gives us a very steady light. The engine is of the upright class, 275 horse-power, and makes 50 revolutions per minute; its speed is very regular, and does not vary over one or two revolutions per minute at any time; when we first installed the plant, we put in a small engine so that we could run either from the small engine or from the main engine, but the results were so much more satisfactory from the main engine, that we removed the small one. The dynamo is placed near the engine-room, and is under the charge of our engineer, who has to attend to it in addition to his regular duties; his shift is 11 hours, and during that time it does not take more than fifteen minutes of his attention, so that the care of this plant is very slight.'

From the above you will observe that there is no truth in the rumors that you report.

We would suggest your calling on our General Manager, Mr. J. H. Flagler, at No. 104 John St., on the subject of the lighting our yards with the Edison Light.

Yours truly,
E. C. CONVERSE,
Assistant General Manager."

PHILADELPHIA, PA. WOOLEN MILL TESTIMONIAL. The following is a copy of a letter received by us:

"Philadelphia, March 5th, 1883.

To the Edison Company for Isolated Lighting.

Gentlemen:—Our Edison Electric Light plant of 500 lamps, which you have furnished to us, has been used by us this winter with great success. The

lighting of our mill has been such that we use it for all night work on our darkest goods (black worsted yarns) with much satisfaction, and with great economy. We are at no extra cost for attendance, and one ton of coal we find ample for four hundred lamps running for fifteen hours. The absence of heat and impure air caused by gas burners is very noticeable in its effect on the night operatives, who are better able to attend to their work in consequence.

Giving you permission to refer to us, and wishing you success in your enterprise, we are,

Yours respectfully,

FISS, BANES, ERBEN & CO."

LENNI, PA. TESTIMONIAL. We have received the following testimonial relating to the plant installed for the Parkmount Mill Company:

"LENNI, PA., March 3d, 1883.

EDISON COMPANY FOR ISOLATED LIGHTING.

DEAR SIRS:—We have been lighted 161 hours with the Edison Electric Light. Have had five lamps broken. We are very much pleased with the light.

Yours truly,

THE PARKMOUNT MILL CO.,

Per GEO. BATES."

STEAMER "PILGRIM" PLANT. The plant on the "Pilgrim," belonging to the Old Colony Steamboat Company, mentioned in the Fourteenth Bulletin, is finished. It consists of 910 lamps, one L, and two K dynamos, (with a capacity of 11,356 candle power), and two Armington & Sims engines (one 8½ by 10 B engine, and one 9½ by 12 C engine), belted directly to the dynamos. Steam is furnished by a special boiler of about 95 H. P. capacity, with 80 pounds pressure; steam connections are also made with the donkey boiler, and with the ship's main boiler, for emergencies. The dynamos can be used either together or separately, and are regulated by the Edison automatic regulator. The current is taken from the dynamos to the main deck by an Edison electric tube, running vertically on the forward side of a mast to the ceiling of the main

deck, and there dividing to each side of the boat. Each branch then runs aft to the centre of the boat, whence all run vertically to the ceiling of the gallery deck. Care has been taken throughout the whole wiring to provide such a system as to prevent the lights from being extinguished by an accident to the boat, and, to that end, the wiring has been divided into four sections, each of which is entirely independent of the others, and each is furnished with its own proper complement of safety appliances. Each fixture, whether it be a large chandelier in one of the saloons, or a single light in a stateroom, is also furnished with the Edison safety-catch. The grand saloon is illuminated by one large chandelier of 36 lights, and two chandeliers of 27 lights each, each chandelier having four tiers of lights, every tier being controlled by a separate switch, and each chandelier being supplied from two separate sections of conductors. There are also on the saloon deck three small electroliers of 8 lights each, four newel-post fixtures, five two-light brackets in each side passage, and four additional two-light brackets at other points. The gallery deck receives the greater portion of its light from the large electrolier in the main saloon, and has also one eight-light, and one twelve-light electrolier, five brackets in the side passages, and one four-light bracket aft. The remainder of the lamps are distributed in the social hall, the quarter deck, dining saloon, freight deck, engine and boiler room, fire room, barber's shop, captain's office, kitchen, pantry, officers' quarters, staterooms, and miscellaneous portions of the boat, there being no gas or other light on the vessel.

The plant is what is known as the Edison "A" system, with an electro-motive force of 110 volts, the lamps used being of 16 and 10 candle power, as required. The total number of lamps is distributed about as follows, viz.:

	16 candle power.	10 candle power.
Gallery and Grand Saloon	199	250
Main Deck	131	138

	16 candle power.	10 candle power.
Dining-room and Aft Cabin...........	32	110
Forward Cabin	14	36
	376	534

16 Candle Power A Lamps 376
10 " " " 534
Total.................. 910

NEW HAVEN STEAMBOAT PIER LIGHTED. We are now lighting this Pier with 43 lamps from the Central Station on Pearl Street. There are 5 lamps in the upper office, 4 in the lower office, 29 on the pier, and a five-light cluster over the main entrance to the pier. The circuits are run in divisions of five, each controlled by a separate switch.

STEAMSHIP "TARAWERA" PLANT. We learn from London that a report from the Captain of the "Tarawera" states that the Edison plant worked well throughout the voyage from Greenock, Scotland, to Melbourne, Australia, and that only 10 of the 150 lamps broke on the passage.

CANADA. CORNWALL MILL LIGHTED. The Cornwall Mill, belonging to the Canadian Cotton Company, Cornwall, is now lighted with an isolated plant consisting of one K dynamo and one L dynamo, 516 A, and 4 B lamps. The largest number of lamps is in the "Weave Shed," a structure 500 feet long and 120 feet wide, lighted by 425 lights suspended from the ceiling a little over 6 feet from the floor. The remaining lights are distributed through the picker room, engine room, and offices. The lights are so managed as to be turned off by convenient switches, in groups of about 30 each.

CLEVELAND. WILSHIRE BUILDING LIGHTED. We have installed a plant of one K and one L dynamo, with 400 A lamps, in the Wilshire Building, Cleveland, Ohio, belonging to Mr. J. B. Perkins.

LONDON, ENGLAND. HOLBORN RESTAURANT LIGHTED. This plant, which consists of two K dynamos, and about 1,000 lamps, chiefly B, has recently been completed, and is now running. The restaurant has been handsomely redecorated, and the success of the light is perfect.

HOUSE OF COMMONS. LONDON. The Edison London Company is installing a plant of one L dynamo, and 150 A lamps, to light the library and dining room of the House of Commons during the ensuing session.

NEW YORK. "MAIL AND EXPRESS" TO BE LIGHTED. We are installing 45 lamps in the press rooms and offices of the Evening *Mail and Express*, which will be lighted from the Pearl Street Station. There are several other departments of this newspaper where artificial light in not used during the spring and summer months, but which will be equipped with lamps in the autumn.

TESTIMONIAL FROM ANAMOSA. By permission of Mr. Swinyard, we print the following from the Warden of the Anamosa, Iowa, penitentiary:

"ANAMOSA, February 20th, 1883.

THOMAS SWINYARD, ESQ.,
Vice-President Dominion Telegraph Co.,
Hamilton, Canada.

DEAR SIR:—Yours of the 5th instant received in due time. I should have answered before if I had been at home—hence the delay.

In answer to the inquiries as to the result of our further experiments, I will say that it exceeds my fondest expectations, and I would not do without the light for twice what it has cost. It gives us no trouble in any manner whatever; and what is better than all, we have light wherever we want it. When we do not wish to use all the lights, we use exactly the number that is required.

Our Engine and Dynamo are run and taken care of by a Convict, so that we are nothing out for labor. We find that any ordinary mechanic can run and take care of the machinery. There is not the slightest danger of fire; no glare or flicker; perfectly steady, and as the Yankee would say 'more than perfect.' *I cannot say too much in its favor.* As to the cost I will write you in June or before. We are keeping a record of the exact time each lamp burns, and as soon as the weather warms up, so that we will not have to use any of the steam from the boiler that we use for the light, I shall weigh all the coal, and keep an exact account of all expenses per lamp, and will report to you the result. Yours respectfully,

A. E. MARTIN, Warden."

EDISON'S FACTORY IN FRANCE. MR. BATCHELOR COMPLIMENTED. The following compliment to Mr. Batchelor appeared in *La Lumière Electrique*, in an article written by M. Th. Du Moncel:

"The establishment of the Edison Company, at Ivry-sur-Seine, is very remarkable in every respect; it is where the electrical apparatus is manufactured which enters into the Edison system of lighting. We have already devoted in a number of this paper, August 12th, 1882, a long article to the description of this factory at Ivry, and we will now simply add that the factory is now employing 200 workmen, and that the portion of the factory which is devoted to the manufacture of lamps, is turning out 400 lamps a day, to say nothing of dynamos and other apparatus. This establishment has been started in less than a year, and reflects the highest credit on its manager, Mr. Batchelor."

PROGRESS IN MANCHESTER, ENGLAND. A small central station has been established by the Manchester and District Edison Electric Light Company, Limited, in Mount Street, in that city, from which it is proposed to supply the public buildings etc., in the neighborhood, as soon as permission to cross streets with conductors is obtained from the Manchester corporation. There are now installed in this station four K dynamos having a capacity of two hundred and fifty lights each; also a Z dynamo. It is intended, however, to extend the capacity of this station to 10,000 lights. The motive power is supplied by two high and low-pressure engines, especially designed by Messrs. Mather & Platt, of the Salford Iron Works, steam being furnished by three boilers of the semi-portable, multi-tubular type.

In connection with the plant in the composing and editorial rooms of the *Manchester Guardian*, we take the following extract from a late issue of *The City*, a newspaper published in London:

"The compositors state that not only is the light more agreeable to work by, but that they no longer suffer from lassitude, as when gas was used. One evening lately, was necessary to resort for an hour or two to the old mode of lighting, while some slight repairs to the engine were being made. As soon as these were completed, the re-appearance of the electric light was greeted with a general cheer."

The following is an extract of the *Electrical Review*, London, January 27th:

"The Manchester and District Edison Electric Light Company has just fitted up the Theatre Royal in that city with 460 of Edison's incandescence lamps. The work has been done under the personal direction of Mr. R. Ruddle and Mr. A. E. Greener. Two hundred of the incandescence lamps, each with a stated illuminating power equal to sixteen candles, take the place of the 225 gas jets in the sunlight, and the remainder of the lamps, all of the same power, are distributed in other parts of the house. In the ceiling of the dress circle promenade there are five electroliers, each carrying a luster of lights. The lamps are said to give a fine light, and illuminate the theatre in a way entirely beyond comparison with gas as formerly used. We understand it is contemplated to adopt the same system of lighting at the Prince's Theatre in the course of this year."

NEW YORK CITY. FULTON MARKET. We are lighting the stall of Fish Commissioner Blackford, Fulton Market, from the Central Station in the First District. At the exhibition of live trout given by Mr. Blackford on the 2d of April, the tanks containing the fish were lighted by means of Edison lamps submerged in the water.

LONDON. SUCCESS OF OUR STREET LIGHTING. The following is an extract from the Report on Works executed during the year 1882, by the Hon. the Commissioners of Sewers of the City of London:

"The arrangements entered into with the Edison Company for lighting with their incandescent lamps the public way of the Holborn Viaduct were carried out, and that thoroughfare was lighted for three months, from the 24th April, free of cost to the Commission.

At the expiration of that time the Company applied for permission to continue the lighting for a further period of six months, the Commission to pay them the same amount as they would have had to pay for the ordinary gas lighting; this was agreed to, and the contract was satisfactorily carried out until the 24th January. The Company then applied for an extension of their contract for one year, still agreeing to light the public way at the same price as gas. This, subject to the power of the Commission to make the contract cease in certain eventualities, has been agreed to, and the Company is still lighting the Viaduct.

In addition to lighting the public ways, the Edison incandescent lights were introduced into nearly all the private buildings and shops fronting the Viaduct, the Edison Company making their own arrangements with the various occupiers.

When the experiment was commenced, the Edison Company placed two incandescent lamps in each of the public gas lanterns; they have since made various experiments with different shaped lanterns and different arrangements of clusters of incandescent lamps, but of which it is scarcely necessary to give the details here, as it will be referred to more fully in a special report on the subject.

This is the first instance in London of a public thoroughfare being lighted by incandescent electric lights, placed on each of the gas lamp columns; the object sought is the uniform diffusion of light over the entire surface of the street, which is indeed the only sound principle of lighting important public thoroughfares."

MAINE. A TANNERY LIGHTED. We are installing a plant of one Z dynamo, and 60 A lamps, in the tannery of Messrs. F. Shaw & Brother at Grand Lake Stream, Maine.

STATE HOUSE LIGHTED, BOSTON, MASS. We have installed a plant of one Z dynamo with sixty A lamps in the State House at Boston. At present the lights are all used in the House of Representatives. The House is lit by an electrolier containing twenty-five lamps, suspended from the centre of the dome, and by a number of two and three-light brackets. On each of the clerks' desks is a portable library lamp, and in the reporters' gallery are

three lamps arranged on fixtures similar to the ordinary student's lamp. These various circuits centre at a switch-board near the door-keeper's desk, from whence the lights may be turned on and off, in groups of various numbers, at pleasure. The dynamo is placed in the engine room, and is driven by the engine used to drive the ventilating blowers. The House was formerly lighted by gas, and when a session was at all prolonged, the heat and impure air produced by the gas jets rendered the atmosphere exceedingly uncomfortable. The Edison light has given great satisfaction, both on account of the increased illumination, as well as by the fact that the purity of the air and heat of the room are not at all affected by its use.

SEVENTEEN DAYS' CONTINUOUS RUN OF AN ENGINE AT THE CENTRAL STATION. We quote the following from the New York *Evening Telegram*, March 27th, relating to a test of one of the engines at the Central Station, First District:

"This morning at half-past five the men on duty in the Edison lighting station at Pearl and Fulton Streets, startled the quiet of dawning by a wild cheer and cries of 'Bully for the Lawrence. She's done it this time if she never does it again.' With them was a *Telegram* reporter, who stood, watch in hand, waiting for the half hour, and whose announcement of the time was the cause of the sudden explosion of rejoicing. They were all, reporter and engine men, grouped around an engine used for giving force to the dynamo electric arrangement of armature and commutator, which furnishes light to late workers, such as journalists, in the lower part of town. The engine in question had performed the feat of running at a speed of 350 revolutions per minute, for the space of sixteen days and sixteen hours, without any cessation. The chief engineer, Mr. Vanderveer, said:—'Mr. Edison was among the first to use high-speed stationary engines. He reflected that a locomotive of 200 horse power, when making a mile a minute, as such engines often do, both with trains and without them, was compelled necessarily to make 300 strokes a minute, and this, too, often over a roadbed whose inequalities must cause considerable vibration. So he ordered from Armington & Sims, of Providence, R. I., an engine of 350 revolutions, and of 175 horse power, because, obviously, the stationary engine could attain high speed with greater safety than the locomotive. At first we had some difficulty in oiling certain parts liable to get heated and hard to come at, such as the crank pin of the balance wheel, and

the pin of the eccentric in the governing wheel. But I introduced a modification of the cup that catches the oil. Perhaps without this she could not have run for this length of time without stopping. Mr. Edison calculated that if she ran sixteen days and sixteen hours, it would be equivalent to a run around the circumference of the globe, 24,000 miles. She is going at a rate equivalent to sixty miles an hour. Multiply that by twenty-four, and we get 1,440 miles for her day's run. Multiply that again by sixteen and two-thirds days, and we get 24,000.'

'And when will you stop her?' asked the *Telegram* reporter.

'This afternoon, when she will have completed seventeen full days. She started Saturday, the 10th of this month. Before this run she went eleven and one-half days without stopping.' "

BOSTON "ADVERTISER" PLANT. We take the following extract from the *Daily Advertiser*, Boston, February 19th, relating to the plant installed in the premises of this newspaper:

"The *Advertiser* will enjoy at night a very different light from what it was familiar with in its youthful days. From the days of tallow candles and whale oil, it has passed through gas to electricity, and now sees its busy toilers working under the new Edison lights. In the basement is a large machine for the generation of electricity, and in the different departments are more than one hundred and fifty of these brilliant pear-shaped glass bulbs shining with the thread of fire. Steady and soft, this light also possesses the merits of not heating the air, and of not burning up the oxygen which is so essential in a thriving brain-working establishment. This light is used in only one other newspaper office in this city—the *Herald*,—and elsewhere than in Boston it is used in the following newspaper offices: The New York *Times*, New York *Herald*, Baltimore *Sun*, Philadelphia *Ledger*, Ohio *State Journal*, and Philadelphia *Record*, as well as in many other newspaper and printing offices. The machine, which is in the basement of the *Advertiser* building, is different from any other in use in this part of the State, and is the most nearly perfect of any yet made."

HOW GAS VITIATES THE AIR. Dr. Lethby, in "Newbigging's Hand Book for Gas Engineers" is the authority for the statement that a gas jet giving 12 candles of light gives off 2,155,364 foot pounds of energy per hour, or will heat 2,786 pounds of water one degree Fahrenheit in one hour. The same gas jet consumes 5.45 cubic feet of oxygen, produces 3.21 cubic feet of carbonic acid, and vitiates 80.2 cubic feet of air in the same time.

DANGER FROM GAS. Several gas explosions, caused by leakage of gas mains, took place near Twentieth and Brown Streets, Philadelphia, at an early hour on the morning of October 19th. One explosion in a defective main blew out an iron grating at Twentieth and Ogden Streets, threw it 100 feet into the air and tore out the earth and stones around. A minute later a similar explosion followed one square away, at Twentieth and Polar Streets. A third explosion followed at Twentieth and Parish Streets, and a fourth at Twentieth and Brown. Flames then burst out at several places, throwing volumes of fire into the street. The houses were shaken within a radius of several squares and great excitement ensued. Many were injured. * * * The street lamp at the corner of Fulton and Greene Avenues, Brooklyn, being filled with gas through a leak in the pipe early in the morning of October 19th, before the lights were extinguished, exploded, blowing the lamp to pieces. * * * Thomas C. Hoagland, a traveling agent for a New York wholesale warehouse, was found October 16th, in his room at the American House, Dover, N. H., asphyxiated by escaping gas. * * * On the 27th January, a serious explosion of escaping gas occurred in a man-hole of the American Steam Heating Co., at Broadway, and Maiden Lane, New York City. The two covers of the man-hole were blown with a great noise in fragments to a height of over a hundred feet. A broad sheet of fire and clouds of smoke came out of the man-hole. Windows on the third and fourth floors of the building on the northeast corner were broken, and the glass fell into the street with pieces of the man-hole covers. Walter W. Hunt and Nathan Simon were injured and taken to the hospital. Several other persons were partly stunned; among them Jeremiah Consellor, of Newark, N. J. * * * A gas explosion took place at the residence of Lady Brooks, No. 82 Eccleston Square, London, England, wrecking part of the house, causing a slight fire, and also,

doing damage to other property in the neighborhood. Louisa Bloomfield and Ursula Bloomfield were considerably burned in several parts of the body, the former seriously. * * * On January 10th an explosion of gas occurred in Queen Anne Street United Presbyterian Church, Dunfermline, Scotland. The force of the explosion blew out the six windows of the session house, lifted the roof from its position, and did considerable damage to the church itself. * * * On the 25th January, an explosion, caused by escaping gas, occurred in the purifying room of the gas works, at Lansing, Michigan, making almost a complete wreck of the building. The roof was blown some distance in the air, turned round, and completely shattered. The South gable wall was prostrated, falling upon a two-story brick cooper shop adjoining, crushing it to the ground. * * * On January 26th, escaping gas, which had accumulated in a man-hole at the corner of Fulton and Nassau Streets, New York City, exploded, throwing an iron man-hole box, which was about four feet square, with the heavy granite cross-walk pavement blocks, bricks and Belgian paving stones, in a shower over the Street. Several persons were thrown down by the force of the explosion. John Hess and Lewis Bear were struck by paving stones, and injured. A. Schuchner was passing over the spot at the moment of the explosion, and was thrown by its force to the opposite side of the street, suffering a severe sprain of the right leg. * * * A reservoir, situated on Washington Street, Eastport, Maine, became filled with gas from a defect in the pipe running by it. The escaping gas became ignited and a tremendous explosion occurred. Twenty feet of the street were torn up, and the cover of the reservoir was thrown 60 feet high, crashing through the roof of a factory, 175 feet away. Two boys and a man were blown several feet into the air, but were uninjured. * * * Fire, doing damage to the extent of $400, was caused by a lighted gas jet, January 20th, at 109 Fourth Street, San Francisco, Cal. * * * A

fire was caused January 28th, at 1398 Second Avenue, N. Y. by artificial flowers coming in contact with a gas jet. * * * On February 1st a fire occurred at 134 West 22d Street, N. Y. caused by a curtain coming in contact with a lighted gas jet. Damage $200. * * * A curtain, coming in contact with a lighted gas jet at 15 West 52d Street, N. Y., February 7th, caused a fire resulting in a loss of $3,000. * * * A fire was caused by a lighted gas jet in the store 716 Third Avenue, N. Y., February 9th. * * * A fire, caused by the explosion of a gas meter, occurred February 12th, at 105 Broome Street, N. Y., doing damage to the extent of $300. * * * A curtain caught fire from a gas jet at 222 Greene Street, New York City, February 13th, causing a fire which did damage to the amount of over $500. * * * A fire occurred in the carding room of the Dudley Hosiery Mills at Newton Lower Falls, Mass., February 19th, having been caused by a gas light. The damage to building, stock, and machinery, was $5,000. * * * At 2388 Third Avenue, N. Y., on February 21st, a fire was caused by a gas jet in the window of Garnett Cohen coming in contact with goods. * * * The window curtains in a bedroom in the residence of Mr. M. I. Townsend Burden, 111 Fifth Avenue, N. Y., took fire from a gas light, February 22d. The damage was estimated at $800. * * * Goods in the show window of W. H. L. Jones & Co., 339 Eighth Avenue, N. Y., caught fire from a gas jet February 27th, doing damage to the amount of $100. * * * A window curtain, coming in contact with a gas jet, caused a fire at 109 East 70th Street, N. Y., March 1st. * * * The explosion of a gas jet at 273 Bridge Street, Brooklyn, N. Y , March 3d, caused a fire and loss to the extent of $100. * * * A fire occurred, March 8th, at 39 Prospect Place, Brooklyn, by a window curtain coming in contact with a gas jet. * * * Window curtains, catching fire from a gas jet, caused some slight damage at 208 East 48th Street, N. Y., March 11th. * * * A lighted gas jet

set fire to a curtain at 108 Fourth Avenue, Brooklyn, March 13th, doing damage to the extent of $100. * * * On March 15th, Ann Riley and Mary Riley were found insensible in bed, at 230 Livingston Street, Brooklyn, from suffocation by gas. * * * A serious explosion occurred March 17th, at 34 Appleton Street, Boston, Mass., caused by a leakage of gas. Two houses were almost completely wrecked. The heavy flagstones and stone steps in front of these houses were blown high into the air, and considerable damage was done to adjoining property. Mr. James N. Skinner, of Malden, was passing at the time and was thrown high in the air, falling with the debris into the cellar. Mr. Skinner was badly injured, and was removed to the hospital. Three other persons were seriously injured. The total damage to building and property was estimated at $10,000. * * * On March 24th, an explosion of gas in a building occupied by the Poor Board, at Pittsburgh, Pa., partially demolished the building, and seriously injured two women named Mrs. McKee and Mrs. Archibald. * * * A fire occured while lighting the gas in the show window of a fancy goods store, 517 Greenwich Street, N. Y., March 26th. * * * John Welke, of 149 West Street, New York City, was found in his room March 27th, in an unconscious condition. The gas was turned on. * * * Two fires were caused March 30th, at 81 Fourth Street, and 48 Garden Place, Brooklyn, N. Y., by window curtains coming in contact with gas jets. * * *

No. 18.
MAY 31, 1883.

EIGHTEENTH BULLETIN.

The Edison Electric Light Company,

65 FIFTH AVENUE, NEW YORK.

May 31st, 1883.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

CONTENTS.

FIRST DISTRICT, NEW YORK CITY. This plant still runs with entire success. It has now been in operation since September 4th, without stopping one instant day or night. We are regularly gaining new customers, and connections with additional buildings are being made daily. Our customers are entirely satisfied both with the light and the price, and the present indications are, notwithstanding the fact that in Summer but little light is consumed as compared with Winter, that we shall soon make connections enough with customers to exhaust the entire capacity of the station. We are at present lighting 429 houses wired for 10,268 lamps.

HAVERLY'S THEATRE, CHICAGO. This plant, mentioned in the Sixteenth Bulletin, is in successful operation. The plant consists of one Z and two K dynamos, 637 A lamps, the power being furnished by a 12½ x 20 Armington and Sims engine. The lamps are distributed about the building as follows:

	Lamps.
Gallery, Four 3-light brackets - - - - -	12
Balcony, Two 6-light chandeliers - - - -	12
" headlights - - - - - -	15
" Ten 3-light brackets - -	30
Parquet, Two 8-light chandeliers - - -	16
" headlights - - - - - -	20
" Eight 3-light brackets - - - - -	24
Boxes and Halls. Brackets - - -	28
Ladies' Room, One 2-light bracket. - -	3
Gentlemen's Room, One 2-light bracket. -	3
Cloak Room. Bracket - - - -	1
Dome. Crystal Corona - - - -	74
Foyer. Two 2-light brackets - - -	4
" Two 4 " newels - - - -	8
Box office. Two 1-light brackets - -	2

Lobby. One 4-light chandelier - - - -	4
Private office. 2 electroliers - - -	3
Balcony, Lobby and Hallways, various fixtures	23
Upper Ticket Office and Room. Single brackets	2
Dressing Rooms, Halls, etc. Single brackets -	64
Foot Lights - - - - - - -	50
Border Lights. 3 of 28 and 2 of 35 - -	154
Ground Rooms. 4 of 10 - - - - -	40
Bunch Lights. 8 of 5 - - - - -	40
First Entrance - - - - - - - -	21
Engine Room - - - - - - - -	3
Total Number of Lamps -	637

The Building was formerly lighted with a larger number of gas jets, but is now more brilliantly illuminated by the lesser number of Edison lamps. The calcium lights which have heretofore been a source of considerable expense and annoyance, are now used but little. All the varied stage effects are produced more satisfactorily than before with gas. The parquet and balcony headlights, mentioned above, are two rows of single lamps inserted in sockets protruding from the ceiling of the parquet circle and balcony, and ornamented with fancy shades, giving a brilliant effect. The crystal corona in the dome is an attractive feature of the installation, and commands admiration. The actors have expressed much satisfaction with the light, and state that it is a great relief from the gas formerly used.

TESTIMONIAL FROM R. H. WHITE & CO., BOSTON. The isolated plant in operation in the dry goods store of Messrs. R. H. White & Co., Boston, is giving entire satisfaction, and we have recently received from them the following testimonial:

"518 to 536 Washington Street.

Boston, May 14th, 1883.

Edison Electric Light Company.

Gentlemen—We have had some 750 of your incandescent lights in use three months and a half, and they have given us perfect satisfaction. In fact we should hardly know how to get along without them, and shall shortly double our plant to enable us to light our entire establishment.

Very truly yours,

R. H. White & Co."

STOCK EXCHANGE, NEW YORK CITY. We are now lighting the large room of the Stock Exchange from the Pearl Street Station. There are three electroliers of 66 lamps each, suspended from the ceiling at about two thirds of the distance from the floor. These fixtures are shaped somewhat like an open umbrella, though more flat, and the lamps in each one are arranged in two circles, one of 44 and the other of 22 lights. Each of these circles of lamps is on a separate circuit, and controlled by a separate switch, so that the amount of light used may be varied as necessary.

The following extract relating to this installation is taken from the New York *Tribune*, May 16th:

"After the close of business at the Stock Exchange yesterday the Edison electric lamps which have been placed in the Board room recently were lighted for the first time. The exhibition attracted many members of the Exchange, because it was understood that the use of electric lights in the whole building depended upon the success of the experiment. The room had been made dark by closing the heavy iron shutters of the doors and windows. The levers of the switch-board were touched, and immediately the three clusters of lamps hanging from the ceiling glowed with lights. * * * E. A. Drake, chairman of the Committee of Arrangements, to whom the credit of making the change largely is due, was enthusiastic in his praise of the light.

BERGMANN & CO'S NEW CATALOGUE. Messrs. Bergmann & Co., have recently issued the fourth edition of their illustrated catalogue and price list of electroliers, brackets and other

appliances, adapted to the use of the Edison incandescent light in buildings. It is a large pamphlet of 82 pages, fully illustrated, and contains descriptions and prices. Copies may be had on application to Messrs. Bergmann & Co., Avenue B and 17th Street.

THE CRAIG LIGHT. MISSTATEMENT CORRECTED. The following letter, published in the Montreal *Gazette*, April 21st, speaks for itself:

"To the Editor of the Gazette:

Sir:—On the 13th inst. the following statement appeared in the *Daily Star*, concerning 'The Craig Electric Light,' of which an exhibition had been given the previous evening at the repair shops of the Grand Trunk Railway at Point St. Charles:

'The apparatus has been examined by the Chief Engineer of the Post Office Telegraphs of Great Britain, and a certificate given that it is the best yet invented; and Professor Morton, Principal of the Stevens Institute, Hoboken, although on the Advisory Board of Directors of the Brush Company, has certified that it is the only perfect system in the world.'

Being interested in the development of electric lighting, I determined at once to forward the above statement to the gentlemen referred to, in order to ascertain its truthfulness or otherwise.

Mr. W. H. Preece, engineer and electrician in chief of the postal telegraphs, London, England, cables me as follows:

'London, 19 April, 1883.

'I know nothing of Mr. Craig or his dynamo, and have not given any certificate to any one.'

While Professor Henry Morton, of Hoboken, New Jersey, telegraphs my assistant, Mr. H. M. Byllesby (who was one of the professor's pupils) as follows:

'Hoboken, 17 April, 1883.

'No such statement as you repeat was ever made by me.'

The above disclaimers speak for themselves, and in the public interest I beg to ask the insertion of them in your journal.

Yours faithfully,

Thos. Swinyard.

Hamilton, Ont., 19th April, 1883."

CANADA. VALLEYFIELD FACTORY PLANT. We have received an order from the Montreal Cotton Company for a plant of two K and two L dynamos, 800 A lamps, to light their mills at Valleyfield, near Montreal.

SUPERIOR ECONOMY OF THE EDISON LAMP. Regarding the highly important economic feature of high resistance, in incandescent lamps, the Twelfth Bulletin contained a synopsis of the report of the sub-commission on incandescent lamps, National Exhibition of Electricity, Paris, 1881. That report set forth that there is "greater economy in high resistance lamps than in low resistance." Accordingly the resistance of the four incandescent lamps exhibited at Paris, was carefully measured. The result was as follows, the lamps being measured *cold:*

	Edison,	Swan,	Lane-Fox,	Maxim,
Mean,	241	59	55	72

On this same subject of high resistance, the London *Electrician*, May 5th, 1883, publishes the measurements of resistance of the same four incandescent lamps, recently made by T. P. Barkas, and reported by him, April 26th, 1883, to the Philosophical Society, Newcastle. Mr. Barkas' measuments, like those of the Paris commission, attest the superior economy of the Edison lamp. His measurements of the lamps made both *cold* and *hot*, were as follows:

	Edison,	Lane-Fox,	Maxim,	Swan,
Cold,	250	70	70	70
Hot,	125	38	35	30

STORAGE BATTERIES. AN EXPERT'S ADVERSE OPINION. The London *Electrician*, May 5th, contains a long account of a recent lecture by Mr. T. P. Barkas, before the Philosophical Society, at Newcastle. The following extract from the lecture relates to storage batteries:

"Theoretically, secondary batteries appear to be very efficient—that is, they ought to store the electro-motive force put into them, but practically, from obstacles of various kinds, they do not. There are many practical difficulties in the details of working secondary batteries, and I have seen long rows of Faure batteries, sufficient, if in proper order, to light a theatre with 1000 lamps, unable to light a few lamps in a shop, because of some undiscoverable errors in their arrangement, or some unexplained or undiscovered local discharge."

NOMENCLATURE OF ELECTRICAL UNITS. In a recent lecture before the Chemical Society of Columbia College, Prof. Barker, of the University of Pennsylvania, gave the following concise definitions of the names of electrical units:

ELECTRICAL UNITS.

NAME.	UNIT OF	VALUE IN ABSOLUTE ELECTRO-MAGNETIC UNITS.
Coulomb	Quantity	10^{-1} or One tenth.
Volt	Electromotive Force	10^{8} " One hundred million.
Ohm	Resistance	10^{9} " One thousand million.
Ampere	Current	10^{-1} " One tenth.
Farad	Capacity	10^{-9} " One thousand millionth.
Watt (ampere volt)	Rate of Work	10^{7} (or ten million) ergs.
Horse-power	" "	746 x 10^{7} (or 7460 million) ergs.
Joule	Heat	0.238 water-gram-degree cent.

TESTIMONIAL FROM THE BIJOU THEATRE, BOSTON. The following testimonial has been received from Mr. E. H. Hastings, General Manager, Bijou Theatre, Boston:

"BIJOU THEATRE, Boston, May 18, 1883.

SPENCER BORDEN, ESQ.,
Manager New England Department,
EDISON ELECTRIC LIGHT CO.

DEAR SIR:—We desire to express to you our complete satisfaction with the electric lights furnished by you to this Theatre in December last. The system

in all its operations has proven faultless, and most admirably adapted for our purposes, and, as it has been in constant use for nearly six months, never requiring alteration or repairs, Mr. Edison and your Company are certainly to be warmly congratulated on the absolute success attained.

Very truly,
BIJOU THEATRE CO.,
By EDW. H. HASTINGS."

BATESVILLE, VA. INDUSTRIAL SCHOOL PLANT. We have received an order for a plant of one K dynamo and 250 A lamps, to be installed in the Miller Industrial School, Batesville, Va.

TESTIMONIAL FROM AMORY MILLS. We have just received the following testimonial from the Amory Manufacturing Company, Manchester, N. H., regarding the Edison plant installed in the Amory Mill.

"EDISON ELECTRIC LIGHT COMPANY,

GENTLEMEN:—In reply to your favor of May 15th we would say, that last fall we displaced 500 4-feet burners with 250 of the Edison incandescent lights 16 C. P. each. That we pay $1.60 for gas and comparing the cost of your light with the 500 burners displaced, we find that in 6 months' time we have effected a saving of $1,021.60. With this showing we are obliged to endorse it.

Yours truly,
G. P. WHITMAN, Agent."

THE "POST" ON STORAGE BATTERIES. The following article on storage batteries is taken from the New York *Evening Post*, May 1st:

"During the last few weeks it has been rumored that the storage batteries, of which so much has been written of late, and a form of which the Brush Electric Light Company are preparing, according to the officers of the company, to put in for lighting New York buildings, are not quite what was hoped. Some specimen batteries, manufactured by the Faure Storage Battery Company, of Belgium, were sent over to this country by the *Labrador* about a year ago, since when little has been done to put the system into practical use. The original American Force and Light Company, holding

patents from the Belgian Faure Company, became entangled in a number of suits with the parent company which are not yet settled. In the meantime the original American Company sold rights covering the whole of the United States to four sub-companies. * * * Last autumn the sub-company holding the rights for railroad-car accumulators put some batteries upon the cars of the Pennsylvania Railroad, but they have since been taken off, owing, according to the officers of the company, to the litigation in which the patent rights were involved.

Among some scientific men who have studied the matter attentively, the storage battery is still regarded as an expensive toy, containing perhaps the germ of a great discovery, but as yet unfit for practical work. The trouble with it is, that after a number of charges the lead plates deteriorate and become worthless. At first the batteries or accumulators work well, although according to Professor Barker, of the University of Pennsylvania, not more than fifteen per cent. of the electricity which is put into an accumulater can be drawn out of it again. The enthusiasm of investigators has usually lasted until the battery had been recharged repeatedly, when serious trouble began to appear and the lead plates had to be renewed.

Three months ago a New York patent lawyer was sent to Europe to examine the Sellon-Volckmar storage battery on behalf of some American capitalists who thought of investing money in the company which holds rights for this country under the Faure patents. This expert has recently returned, and was called upon by a reporter of the *Evening Post*, to whom he told the following story: He investigated the whole subject of storage batteries from a business point of view, and consulted Preece, the head of the English telegraph lines, Lockyer and Siemens, the well-known scientists, and, indirectly, Sir William Thomson, who first gave reputation to the Faure battery by describing it in a series of letters to the London *Times*. The conclusion reached by the American expert was not favorable to the battery, upon the ground that the lead plates do not last sufficiently long to make the operation of the batteries economical.

The *Evening Post* contained a few days ago an account of the preparations making by the Brush Electric Light Company of this city to light up the Madison Square Theatre and several business buildings with Brush secondary batteries and Swan lamps. The Faure Company are now suing the Brush Company for infringement of patents, and counter suits by Brush to prevent the sale or use of Faure batteries are said to be forthcoming.

To sum up the matter, nothing practical has yet been done with the batteries, although they have been here for a year, and Professor Barker, Edison, and Stephen D. Field, who have all given considerable study to the matter, do not yet consider the storage battery a practical aid to the use of electricity, while admitting that its possibilities are great."

SUNBURY, PA. A CENTRAL STATION. The Edison Electric Illuminating Company of Sunbury, Pa., has completed its organization, procured its capital, and given us an order to at once install a central station plant, details of which will be given in the next Bulletin. A large portion of the stock of the Company was subscribed for by parties at present using gas but who propose to become customers of the Edison Company.

The officers of the Company are as follows: Frank H. McCormick, President; Thomas C. Detwiler, Treasurer; James W. Sweely, Secretary; Frank H. McCormick, Thomas C. Detwiler, James W. Sweely, Charles B. Story, Seth T. McCormick, Directors.

SHAMOKIN, PA. A CENTRAL STATION. The Edison Electric Illuminating Company of Shamokin, Pa., has ordered us to install a central station plant of 1,600 lights, work on which has been already commenced. Details of the plant will be given in a future number of the Bulletin. A large part of the capital stock of the Company was subscribed for by consumers of gas who propose to abandon gas and use the Edison light.

The officers of the company are as follows: W. H. Douty, President; Holden Chester, Vice President; John Mullen, Treasurer; William Beury, Secretary; W. H. Douty, C. C. Leader, John Mullen, A. Robertson, Holden Chester, William Beury, P. B. Shaw, Directors.

MEASURING ELECTRIC LIGHT AND GAS. The London *Times*, April 7th, contained a letter from Mr. E. H. Johnson on the question of "What method of charge will best develope, and insure to the users of the electric light, the benefits of economic improvements?" The following extract from the letter relating especially to the Edison system of measuring the Edison Electric Light, is of general interest:

"'How can we measure it?' The plan is a simple one. The lamps provided by the Edison Companies are rated at so many candles each. Their consumption of energy is definitely known, and fixed with a current of a given strength. Thus, in the Edison system the standard lamp is of 16 candle-power. This lamp requires three-quarters of an ampere of current to yield 16 candles of light per hour. The bill to the consumer is based upon these known standards. If the consumer has reason to question the accuracy of his bill, he has only to count the number of lamps in use for a given number of hours, multiply the two together, and the total by 16 (the standard of the lamp), and he will have an absolute check. For illustration the Edison Companies present a bill for 48,000 candles of light. The consumer counts his lamps, and takes note of the number of hours they burn, and finds that he has 10 lamps burning 10 hours per day, or one lamp for 100 hours. This for 30 days gives him 3,000 lamp hours. This multiplied by the Company's own standard of 16 candles, yields 48,000 candles, and he has proof positive that the bill is correct. If the bill were more, he has proof of its error, which the Company would be bound to accept, since no matter what number of amperes of current the meter may have shown to have passed, the calculation of the amount of light supplied is made from the basis of so much current per lamp to produce 16 candles of light per hour. If the Company object to the consumer's count, they can make it themselves, or in other ways test the accuracy of their meter. Compare this with the check upon a gas meter. The bill is for 2,400 ft. of gas. An examination of the meter shows the record to be in accord, but does that prove that the consumer has had 48,000 candles of light? No; the larger proportion of his gas may be escaping, and not supplying light at all. Or, if not escaping, his burners may be so wasteful that, instead of getting 16 candles from a 6-ft. burner, he may, as we all know, be only getting eight or ten."

CONTRACTS CLOSED BY THE WESTERN EDISON LIGHT COMPANY. Since the last Bulletin the following plants have been sold by the Western Edison Company:

(1). A plant of one K dynamo and 281 lamps to light the residence of Mr. M. D. Wells, at Chicago, Ill.

(2). A plant of one K dynamo and 250 lights to be used in the First National Bank and Safe Deposit Vaults, where they will displace the Weston arc lights and the Maxim incandescent lights which have heretofore been in use and now abandoned.

THE BOSTON "JOURNAL" ON STORAGE BATTERIES. The following extract from the Boston *Journal*, April 30th, quite fairly states the present views of the best informed portion of the public about storage batteries:

"Almost simultaneously with the report, which I mentioned a day or two ago, that the Brush Electric Light Company were really getting ready to put in their storage batteries, and illuminate New York with Swan incandescent lamps, come equally well authenticated reports to the effect that the value of the storage battery has been greatly exaggerated, and that it is yet nothing more than a laboratory toy of no practical value whatever. I met yesterday a lawyer and patent expert who was sent to Europe this winter on behalf of a number of gentlemen who thought of investing in the stock of the New York company which holds the Faure patents, supposed to be the only valid ones upon storage batteries, Brush to the contrary notwithstanding. This gentleman went to London to find out what had been done over there with it in a practical way, and has just returned. He saw Siemens, the foremost English authority upon the subject; Lockyer, who is among the best English electricians; Preece, who is at the head of British telegraph lines, and besides these scientific men of acknowledged position, he advertised for information regarding storage batteries and questioned all practical men who had had anything to do with the matter. The result was to convince him that it would be unwise to risk money in the storage battery business. At his request Lockyer went to Scotland to find out what Sir William Thomson's experience had been, for Sir William was among the first to give reputation to the storage battery. The story which the great investigator tells is not encouraging to investors in new scientific schemes. He has given more than a year to the study of the storage battery, and confesses that in its present condition it is useless as an economical apparatus. The trouble is that the batteries cannot be recharged more than four or five times; the lead plates disintegrate and fall to pieces after that and have to be renewed. The first result of experiments with storage batteries is to fill the experimenters with enthusiasm; then they find that there is a radical fault in the machine, but so fascinating is the affair that they say little about the snag they have struck and work away hoping to find the remedy. For instance, out of the hundreds of batteries which Sir William Thomson has constructed within the last year and a half, three seem to stand any amount of recharging and discharging; the lead plates in these three remain intact, while all others have gone to pieces long ago. * * * Siemens talks in about the same vein and acknowledges that the scientific world jumped at conclusions too hurriedly. Preece and Lockyer agree with these opinions, and the New York expert came back, and presented a report which has stopped all negotiations for stock in the New York Faure Company.

These views received corroboration to-day. I met Prof. Barker of the University of Pennsylvania, one of the best electricians in the country, and

asked him if the storage battery was the great discovery which Brush and the Faure people had announced; Prof. Barker shrugged his shoulders and laughed.

'There is,' he said, 'the germ of a grand discovery in it, but no one has got to it yet. The plates give out, and too much electricity has to be put into the battery in proportion to what you can get out of it to make it economical. For some purposes, when cost is of no importance, it may be used, but as to it being an apparatus for every day use we are yet a long way off. I was requested to examine the Brush battery by some one who thought of putting money in the stock. I went up to the offices of the Brush Company and asked to see the battery about which so much had been said. I was politely refused, there being a secret about the preparation of the plates they said. I asked whether if I hired one of their batteries for my own use I could examine it. No, I was told, it would be locked with a heavy padlock, and I must sign an agreement not to meddle with it. That ended my investigation.'

Stephen D. Field, a practical electrician of excellent repute, who has done some good work for the Western Union Company, and a nephew of Cyrus and Dudley Field, is rather more outspoken than Prof. Barker. 'The whole thing,' he said to me to-day, 'is an attempt to make more money. The Brush lighting companies throughout the country are not making any profits; the parent company says to them: Here is the storage battery, which completes your arrangements, and will make your whole plant pay enormously; put in some more money and it is yours.' I have been at work at the battery for months, and have given it up. There is something there, but it has not been reduced to a practical shape.'

Prof. Morton, of the Stevens Institute, in Hoboken, has been lecturing within the last week upon the beauties of the battery, but his enthusiasm is probably due to inexperience, for he has been experimenting with the Sellon-Volckmar battery, the same form which Siemens gave up."

WESTERN UNION TELEGRAPH BUILDING. A statement was made in the last Bulletin that the Western Union Telegraph Company's building, New York City, was to be lighted from the Pearl Street Station. At that time a written contract to that effect had been made between the Western Union Company and the Edison Company, but since then, by mutual consent, the contract has been abrogated, and the Western Union Building, certainly for the present, will not be lighted by our Company.

THE CZAR'S CORONATION. EDISON LIGHT. A cable from Moscow to the New York *Herald*, states that at the coronation of the Czar, 3,500 Edison lights illuminated the tower of Ivan the Great.

TESTIMONIAL FROM MESSRS. FISS, BANES, ERBEN & CO., The following testimonial which we have received from Messrs. Fiss, Banes, Erben & Co., who have an Edison plant of 500 A lamps in their Worsted Mills at Philadelphia, will be of interest:

"FAIRMOUNT WORSTED MILLS; Office, 106 Chestnut St., }
FISS, BANES, ERBEN & CO. }

PHILADELPHIA, May 19th, 1883.

MR. JOHN HOSKIN, Agent,
EDISON CO. FOR ISOLATED LIGHTING,
Room 6, Ledger Building, Philadelphia.

DEAR SIR:—In response to your request for statement of cost of electric lighting at our Mill by the Edison Incandescent System, we submit the following:

Number of hours plant lighted since installation of first dynamo..........1,562	
Average *hourly* consumption of gas before introducing Edison light..........2,176½ feet.	
Or, for 1,562 hours, 1,562 x 2176½ ft...3,399,693 "	
Costing 3,399 $\frac{693}{1000}$ x $1.90..........	$6,459.41
Actual cost of gas used in addition to Electric light...	1,391.56
" value of gas light supplanted by electricity.....	$5,067.85

Our expenses for the electric light to supplant this have been as follows, viz:

For installation of light, including all expenses of every kind, and Lawrence engines, for driving..........$12,006.40	
4 months' interest on same @ 6%..........	$240.88
91½ tons Coal @ $3.25..........	297.37
Oil used..........	93.43
Lamps destroyed, 443..........	443.00
Repairing armature..........	47.05
Total..........	$1,131.88

Total cost gas light supplanted..... ....$5,067.85
" " electric light............................... 1,131.88

Net saving.......................... $3,935.97

Comparative cost of gas light to the electric nearly as 5 to 1.

Trusting you will find our method of calculation a reasonably practical one, we are,

Yours truly,

FISS, BANES, ERBEN & CO."

We think that two additional items require mention, to make this letter complete, namely, the expense of an engineer and an allowance for depreciation. Regarding the first, the engineer, Messrs. Fiss, Banes, Erben & Co. make no charge for his services because the regular engineer who attends to the running of the mill engine, looks out for the dynamo, no additional help being employed. As regards the other item, depreciation on the electric plant, we think some charge should be made. The total cost of the plant was $12,006.40, including an independent engine. A very large part of this amount, however, covers wiring, fixtures, etc., which do not depreciate appreciably, leaving only the active parts of the plant upon which the expense of depreciation should fall. A fair allowance for depreciation is three per cent. per annum on the total cost of the plant, although the appreciable depreciation is on only the dynamo and engine. Allowing for depreciation on that basis, it would amount, during the period of four months referred to in the above letter, to $120.07. Deducting this amount from the saving as compared with gas, above given, there still remains a net saving by the use of the Edison incandescent light of $3,815.90.

UTICA "HERALD" LIGHTED. An Edison plant, one Z dynamo, has just been installed in the *Morning Herald*, Utica. The following is from the *Herald*, May 18th:

"In the *Herald* office there are one six-light electrolier, several portable lights, and about 60 bracket lights.

The *Herald* buildings have up to the present time been lighted principally by kerosene lamps with argand burners, tho' gas is used in the counting room and some of the editorial rooms. These numbered in all 83 lights which were nearly all kept burning all night. They are to be replaced by 64 electric lamps which give a far better light. In other establishments the reduction in the number of lamps would be much greater. The following table shows the reduction in the number of lights in each department:

	Electric lamps.		*Oil lamps.*
Press room...........................	4	replace	9
Editorial rooms........................	10	"	17
Counting room	4	"	7
Composing room........	40	"	43
Folding room............	4	"	4
Halls...	2	"	3
Total......	64	replacing	83

When two persons worked in one room, in the editorial departments, they used two oil lamps. One electric light is found to answer the purpose better. In the composing room each workman has three cases which occupy considerable space. Hence but little reduction in the number of lamps is feasible. About half the oil lamps in the composing room have been replaced with the electric lamps and the remaining ones will be in a few days. The electric lamps burned last evening from 7 P. M. until midnight, and no tremor was noticeable in the light after the double cylinder Hoe press began running at 11 P. M. The evening previous the electric lamps were kept burning until 10 P. M. When all the lamps are in, the lights will be kept burning all night."

The same issue of the *Herald* contains the following little tribute to Mr. Edison, which persons with long memories will appreciate:

"—The Edison light 'corners' the diamond match. No match, no flicker, no smoke, no heat—plenty of light. Edison was doing a powerful lot of thinking while 'us fellows' were pointing paragraphs at his delays."

HUNTER'S POINT, L. I. PLANT FOR CHEMICAL WORKS. We are installing a plant of one Z dynamo with A lamps, at the Warren Chemical Works, Hunter's Point, Long Island. The light is to be used in rooms pervaded by volatile gases, highly inflammable.

STRASBOURG. LIFE OF LAMPS IN RAILWAY STATION. PLANT ENLARGED. An Edison plant was installed over a year ago in the railroad depot at Strasbourg. A letter recently received by Mr. Edison speaks as follows about it:

> "The machine No. 32, which was placed in the Station here, has worked every night from dark until daylight since January 5th, 1882, or over 5,200 hours. Of the first 100 lamps there is one still burning, and it has burned for 5,020 hours. The record has been accurately kept by the railroad direction, and the average life of the first 100 lamps has, so far, exceeded 830 hours. The lamps have always been kept at 16 candles by measure."

The best evidence of the satisfaction given by this small plant is the fact that it has been increased from a Z dynamo and about 100 lamps, to a number of large dynamos and 1,200 lamps.

TESTIMONIAL FROM THE DAVENPORT "GAZETTE." The following testimonial is from the *Gazette*, Davenport, Iowa, May 11th. The proprietors own an Edison plant with which they light their own building, and sell light to their neighbors:

> "More than five months ago the first Edison electric light plant used in Iowa was set in operation in *The Gazette* premises. On the night of last Thanksgiving Day the first rays from an Edison electric lamp seen in this State illuminated the editorial, composing and press rooms of *The Gazette*, and the rooms of the Post-office in Davenport. Subsequently, the Ackley House, the wholesale tobacco warehouse of Nicholas Kuhnen, the wholesale and retail clothing store of Robert Krause, and the hat and cap store of W. S. Cameron & Sons were successively supplied with the same illumination, direct from the plant placed in use by *The Gazette*. Continuously since have these several establishments been lighted exclusively by the Edison electric light, and only to the increasing satisfaction of all who have used it or have had opportunity to observe its power and its effect. As to results secured in the editorial, business and press rooms of *The Gazette*, we are certainly prepared to speak understandingly, and with absolute confidence. With *The Gazette* the Edison light long since passed beyond the realm of experiment. The test of nearly half a year is as complete, concerning all that pertain to the quality and satisfactory use of the light, as complete as though it had been in use a score of years. That test has proven the light to be perfect, in the fullest sense of that word. No light ever used in this office has been so grateful to the eye, so soothing to mind, and so contributary to ease in night labor. Personal experience enables us to testify of impared vision strengthened, and irritated eyes relieved of long soreness, under the rays of Edison's grand beneficence to toilers in the night watches. Similarly it is the concurrent testimony of compositors that they can average ten per cent. more work nightly by the use of the Edison light, than in that of any other illuminator by them ever tried. And what is said by *The Gazette* in these directions simply were the opinion of all who have used the Edison light in their respective establishments in Davenport."

FORD'S OPERA HOUSE LIGHTED, BALTIMORE. We are installing a plant of one H machine and 350 A lamps in Ford's Opera House, Baltimore, Md.

TESTIMONIAL FROM PHILADELPHIA. CHEAPNESS OF OUR LIGHT. The following testimonial is from Messrs. John B. Stetson & Co., Manufacturers of Woolen Hats, Philadelphia. Their statement about the cheapness of the light, as compared with gas, shows that their experience in this regard is similar to that of many others of our customers:

> "PHILADELPHIA, May 2d, 1883.
>
> MR. JOHN HOSKIN, Agent,
>
> EDISON COMPANY FOR ISOLATED LIGHTING.
>
> DEAR SIR:—In reply to your request, we give you our full permission to refer to us on the subject of the Edison electric light, and our use thereof. We commenced by using a 60-light dynamo, and shortly after added a second one. After a years trial we concluded to light our whole establishment with it, and therefore increased our plant this winter to five hundred (500) lamps, of sixteen candle-power each. The plant for this consisting of two Edison dynamos, of two hundred and fifty (250) lamps each, and a suitable steam engine for driving them was furnished by you; and it gives us pleasure to acknowledge your care in fulfilling every obligation that you had entered into in setting up this electrical equipment. Our whole establishment is now lighted by electricity, as we have found the light to be bright, and steady to work by on our darkest goods; pleasant to the eye sight, free from danger by fire, and from our late tests we find it to cost us as near as we can calculate, 38 per cent. of what gas would cost us at $1.90 per 1,000 ft.
>
> Very respectfully yours,
>
> JOHN B. STETSON & CO."

PROF. BARKER ON STORAGE BATTERIES. The following extract, from a paper by Prof. Barker, on storage batteries, briefly states his conclusions on the question of storing electricity:

"The commercial aspect of the question of the storage of electrical energy has recently assumed a very considerable importance. But it is evident at the outset, that an agent, which has been produced, and then stored, must cost more when redelivered than when first produced, by exactly the cost of the storage; that is, supposing there is no loss in storing. But there is a loss, and this is almost if not quite one-half of the energy involved, as it would seem from the Conservatoire experiments in Paris, among others. The first cost of the accumulators, the expense of charging them, their low efficiency, and especially their bulk and weight, must ever prevent, it would seem, their competing successfully with the direct use of the dynamo-electric machine, at least with any form of secondary battery yet devised. For special uses, however, the storage battery has a high value. Even if the cost of an ampere of current produced by it is twice as great as if produced directly by the dynamo-machine, this cost is only one-half of that required to give the same current by any available form of primary battery. Where a strong current of low electro-motive force is needed, under conditions where a dynamo cannot be employed, there the secondary battery has its most important field. Its value rapidly decreases as the number of cells is multiplied, as when a high electro-motive force is needed for the production of light. Its chief advantage its transportability; since by placing it near the work to be done, the loss energy on long conductors is obviated."

BALTIMORE "SUN" PLANT. The following extract from a recent number of the Baltimore *Sun*, shows how the proprietors continue to regard our light:

"The *Sun's* new dynamo machine, weighing nearly five tons, has just been received. It contains all of Edison's latest improvements, and will give about 80 per cent. more light than the machine now in use, which it replaces. The Sun Iron Building, with 250 Edison lamps run from this dynamo, will be second in brilliancy to no building in the world. As summer approaches the exemption from the great heat caused by burning gas will be a boon to the great number of busy employees that are through the night actively engaged in bringing the paper in all its details to perfection for its thousands of readers in the morning. The ready way in which the light is turned off and on, and the fact that no matches are required for lighting up, are among the very numerous advantages which the light has over the old system of gas."

ORANGE, NEW JERSEY. RESIDENCE WIRED. We are wiring the residence of Mr. Henry Auchincloss at Orange, New Jersey, for about 85 Edison lights.

NEW YORK "SUN" LIGHTED. We are now lighting the composing room of the New York *Sun* with 98 lamps, the current for which is supplied from the Pearl Street Station.

STEAMSHIP LIGHTING. ANOTHER PLANT ORDERED. We take the following from the London *Electrician* of May 12th: "The Union Steamship Company of New Zealand have entrusted the lighting of their new mail steamer the 'Takapuna,' now finishing at Barrow, to the Edison Electric Light Company. When completed, this will form the third vessel of this line which has been lighted on the Edison system * * *."

LONDON. DANGER FROM GAS. Captain Shaw, Chief Officer of the London Fire Brigade, in his report on fires in London for the year 1881, gives a list of causes of fires for the year. The total number of fires was 1,991, of which 203 were caused by gas, and 158 by other artificial illuminants. There were 37 fires from swinging gas brackets, 73 from the escape of gas, 25 from gas explosions in seeking for escapes of gas, 26 from goods coming in contact with gas lights, and 42 other fires from gas, making a total of 203 from gas alone. There were 145 fires from candles, 4 from candle sparks, and 9 from oil lamps. At 38 fires caused by artificial illuminants (31 of which were caused by gas) 47 persons were injured, 45 of whom recovered and 2 died.

GUION LINE STEAMER TO BE LIGHTED. The London Edison Company is installing a plant of 500 A lamps on the Guion line Steamship "Oregon," now building at Glasgow for service between Liverpool and New York.

EDISON'S CANADIAN PATENTS. The Sixth and Fourteenth Bulletins contained detailed lists of Mr. Edison's United States patents and applications for patents on electric lighting by incandescence. At the date of the Fourteenth Bulletin, the total number of patents issued by the United States Patent Office to Mr. Edison on this subject was 149, besides applications for 135 additional patents then pending. Up to this date the total number of patents issued is 187, and the number of pending applications has been increased by further inventions of Mr. Edison to 167. The most important of these inventions have been patented also in other countries, including Canada.

The Canadian patent practice formerly allowed more than one invention to be embraced in a single patent, being in that respect different from the patent practice of the United States. Accordingly, the number of Mr. Edison's patents in Canada is much less than in the United States. Up to the present time there have been issued to Mr. Edison thirty-seven Canadian patents on electric lighting, and many additional applications for patents are still pending. The following is a list of the Canadian patents already issued to him and assigned by him to the Edison Electric Light Company.

TITLE.	DATE.	NUMBER
1.—Method of and Means for Developing Electric Currents, and Lighting by Electricity....	May 28, 1879	10,031
2.—Electric Lamps and Methods of Manufacturing the Same......................	Nov. 17, 1879	10,654
3.—Electric Lamps and Methods of Manufacturing the Same.......	Jan. 10, 1880	10,791
4.—Electric Lamps and Methods of Manufacturing the Same....	July 19, 1880	11,520
5.—The Utilization of Electricity for Light, Heat, and Power, being an Improved System and Means for the Generation, Regulation, Distribution, Measurement and Translation of Electricity into Light, Heat and Power.	July 21, 1880	11,527
6.—Dynamo or Magneto-Electric Machines and Electric Motors.......................	Oct. 9, 1880	11,857
7.—Electric Lamps and Carbons or Incandescing Conductors therefor, and Means for and Methods of Manufacturing the same......	Nov. 11, 1880	11,968
8.—Systems of Conductors for the Distribution of Electricity as a Lighting and Motive Power Agent, and appliances connected therewith.	Nov. 15, 1880	11,997
9.—Means for Measuring the Amount of Electrical Current flowing through a Circuit..	Nov. 29, 1880	12,049
10.—Magneto or Dynamo-Electric Machines, applicable to both Generators and Engines..	Mar. 31, 1881	12,567
11.—Webermeters, or Devices for Measuring and Registering the Current flowing through Conductors......................... ...	June 30, 1881	13,044
12.—System of Electric Lighting, Electric Lamps and constituent parts thereof, and Means and Methods of Manufacture connected therewith....	July 5, 1881	13,057
13.—Devices for Measuring the Electric Current passing through or used upon a certain Conductor	Aug. 1, 1881	13,208
14.—Electric Arc Lights	Aug. 26, 1881	13,315
15.—Commutators for Dynamo or Magneto-Electric Machines or Electro-Motors	Sept. 23, 1881	13,467
16.—Dynamo or Magneto-Electric Machines... .	Nov. 20, 1881	13,734
17.—Magneto or Dynamo-Electric Machines or Electric Engines	Nov. 20, 1881	13,753
18.—Electric Lamps and the Manufacture thereof.	Dec. 14, 1881	13,835
19.—Dynamo or Magneto-Electric Machines. ..	Dec. 14, 1881	13,836
20.—Systems of Electric Lighting	Dec. 21, 1881	13,875
21.—The Manufacture of Carbon Conductors for Incandescent Electric Lamps...........	Dec. 26, 1881	13,886
22.—Meters for Measuring Electric Currents.....	Dec 26, 1881	13,900
23.—Electric Chandeliers........................	Oct. 17, 1882	15,642
24.—Fittings and Fixtures for Electric Lamps....	Oct 19, 1882	15,646
25.—Fixtures and Attachments for Electric Lamps	Oct. 20, 1882	15,654

TITLE.	DATE.	NUMBER
26.—Electric Lights and Fittings and Fixtures therefor	Oct. 25, 1882	15,693
27.—Electric Motors	Nov. 21, 1882	15,816
28.—Electro-Magnetic Motors	Nov. 21, 1882	15,822
29.—Underground Conductors	Nov. 22, 1882	15,830
30.—Electrical Distribution Systems	Nov. 22, 1882	15,831
31.—Electrical Distribution Systems	Nov. 22, 1882	15,832
32.—Current Regulators for Dynamo-Electric Machines	Nov. 23, 1882	15,843
33.—Electric Lamps	Nov. 23, 1882	15,844
34.—Electric Lamps	Nov. 23, 1882	15,845
35.—Regulators for Magneto or Dynamo-Electric Machines	Nov. 23, 1882	15,846
36.—Regulator for Dynamo or Magneto Electric Machines and Electro-Motors	Nov. 23, 1882	15,847
37.—Regulators for Magneto or Dynamo-Electric Machines	Nov. 23, 1882	15,848

TESTIMONIAL FROM F. SHAW & BROS. We have received the following testimonial from F. Shaw & Bros., manufacturers of sole leather:

"KINGMAN, ME., May 24th, 1883.

THE EDISON CO. FOR ISOLATED LIGHTING,

SPENCER BORDEN, MANAGER NEW ENGLAND DE'PT.

DEAR SIR:—Since changing from the 120-light machine (8 candle-power) to the 60-light machine (16 candle-power), we will say that we are more than pleased with the light. We have been running the lights constantly throughout each night for several months, and up to this time have had little or no trouble, the lights burning steadily without any flickering and very brilliant.

The cost of running your lights compared with any other artificial light is in our opinion a great saving, and to us, thus far, the cost has been very small outside of power (which is surplus), merely the oil and attention of one man, the machine sometimes running whole nights without being touched.

We remain,

Yours respectfully,

F. SHAW & BROS."

ANOTHER PLANT INCREASED. The Old Kentucky Woolen Mills (Messrs. L. Richardson & Co.), Louisville, Ky., have ordered their plant heretofore installed, which was one K dynamo, 250 A lights, to be at once increased to one H dynamo, 350 A lights.

COST OF THE EDISON LIGHT COMPARED WITH ARC LIGHTS AND GAS. Mr. Sidney B. Paine, Assistant Manager of the New England Department of the Edison Company at Boston, has recently prepared a valuable paper on the cost of the Edison system of incandescent lighting, compared with arc lights and gas in factories. His paper, printed in the *Cotton, Wool and Iron*, Boston, April 14th, is copied below:

"We publish below, as nearly as we can ascertain it, the absolute facts of the cost as between the arc and incandescent systems of lighting. We believe it will be of interest to manufacturers, and it will be seen that the data given is intended to be from the stand-point of absolute accounts which have been verified by manufacturing concerns.

This estimate is based upon the requirements of a weave shop containing 1,000 forty-inch looms manufacturing white shirtings. To light this room properly will require 40 arc lamps (one lamp to twenty-four looms), or 250 Edison 16 candle-power incandescent lamps (one lamp to four looms). This distribution of the light is the one which has been found, in actual practice, to give equal results.

The estimate on the running expenses of the arc system is based upon a statement made by Col. Thomas Livermore, before the New England Cotton Manufacturers' Association, in October, 1882. This gentleman is using 464 arc lights (about half being Brush, and one-half Weston) in the Amoskeag Mills, in Manchester, and has kept very accurate accounts of the expenditure entailed by these systems. The estimate upon the running expenses of the Edison system is also based upon actual practice. From this experience the Edison Company has made full guarantees, thus protecting the manufacturer. As the Edison Company has protected *itself* in making these guarantees, the manufacturer will realize better results than those given below. These latter expenses are therefore the maximum.

FORTY-TWO ARC LAMPS.

This plant, as installed by the Brush Company, will cost $7,000, including wiring. The power required will be 42 horse-power, which at $1\frac{87}{100}$ cents per horse-power per hour ($50 per horse-power per year), will cost 70 cents per hour.

The "labor, carbons, and repairs," at 2 $\frac{87}{100}$ cents per lamp per hour, will cost $1.21 per hour.

The "depreciation," as estimated by Col. Livermore, amounts to $\frac{2}{10}$ cents per hour per lamp, equal to eight cents per hour on plant in question.

TWO HUNDRED AND FIFTY EDISON INCANDESCENT LAMPS.

This plant, as installed by the Edison Company, will cost about $4,000, including wiring. The "power" required will not exceed 35 horse-power, which at 1 $\frac{67}{100}$ cents per horse power per hour will cost 58 cents per hour. The "lamps and brushes," estimating that the Edison Company is called upon to make good its guarantees of an average life of 600 hours for the lamps (renewal $1 each) and of 200 hours for the brushes ($10 per set) will cost 47 cents per hour. The "depreciation" of the Edison system, assuming that the Edison Company is required to make good its guarantee of 1500 hours life for the "commutator" (renewal $50) will amount to three (3) cents per hour. There is no cost for "labor" connected with the Edison system, other than that included in the charge of 1 $\frac{67}{100}$ cents per horse-power per hour, inasmuch as the dynamo can be placed in the engine room, and the engineer can pay it all the necessary attention without interfering with his legitimate work. This charge (1 $\frac{67}{100}$ cents per horse-power per hour) is extremely high. It covers all labor of engineer and fireman, fuel, water, oil, waste, and all depreciation, interest, taxes, and insurance on steam plant, consisting of engine, foundations, heater, boilers, stack, engine and boiler house. These charges, in an ordinary equipment, ought to be covered by $40 per horse power. While this basis may answer for the purposes of the present comparison (as both systems are brought to the same basis), it is evidently inproper to adopt it, in comparing either of the above systems with any other, unless such other be first brought to the same level.

Tabulating the comparative estimates given above, we have the following running expenses (exclusive of interest) for lighting the above room for one hour:

	42 Arc Lamps, $7,000.	250 Edison Lamps, $4,000.
Power	$0.70	$0.58
Labor, carbons, lamps, repairs	1.21	.47
Depreciation	.08	.03
Hourly expense, exclusive of interest	$1.99	$1.08

To light the above room with gas would require 500 4-foot burners. The piping for the above number of burners would cost, at the lowest estimate, $1,500. These burners would consume 2,000 feet per hour, which, at $1.60 per thousand, will cost $3.20 per hour.

If, instead of steam power, as figured above, water power is used, the cost will be very materially reduced. In Lewiston, water power sells for $5 per

horse-power per annum; interest on the plant and labor will not exceed $5 per horse-power, bringing the outside cost per year to $10 per horse-power. On this basis, the power, necessary to produce the arc lights in above example, will cost 14 cents per hour, and to produce the 250 Edison lights, 12 cents per hour.

The following table gives a view of the comparative hourly expense, (including interest) of lighting the above room by the three systems, the 'lighting time,' or time during which light is required, is assumed to vary from 300 to 3,000 hours per year, in order to cover all probable cases, and the hourly expense is reckoned accordingly. Appended to this table are four columns showing the saving (reckoned as a percentage on the first cost—$4,000—of the Edison plant) obtained by the use of the Edison incandescent light over arc lights and gas:

Running Time.	Gas at $1.60.	Steam Power. Arc.	Steam Power. Edison.	Steam Power. Equiv. of Gas. Arc.	Steam Power. Equiv. of Gas. Edison.	Water Power. Arc.	Water Power. Edison.	Water Power. Equiv. of Gas. Arc.	Water Power. Equiv. of Gas. Edison.	Saving by Edison. Steam. Arc.	Saving by Edison. Steam. Gas.	Saving by Edison. Water. Arc.	Saving by Edison. Water. Gas.
300	$3.50	$3.39	$1.83	$1.55	$0.86	$2.80	$1.42	$1.28	$0.65	11%	12%	10%	16%
400	3.46	3.04	1.68	1.42	.78	2.45	1.22	1.14	.57	14%	18%	12%	22%
500	3.38	2.88	1.56	1.34	.74	2.24	1.10	1.06	.52	16%	23%	14%	29%
600	3.35	2.69	1.48	1.08	.71	2.10	1.02	1.00	.48	18%	28%	16%	35%
700	3.33	2.57	1.42	1.24	.68	2.00	.96	.97	.46	20%	33%	18%	41%
800	3.31	2.52	1.38	1.22	.67	1.93	.92	.91	.45	21%	37%	[illegible]	42%
1,000	3.29	2.41	1.32	1.17	.64	1.82	.86	.89	.42	27%	50%	24%	61%
1,250	3.27	2.33	1.27	1.14	.62	1.74	.81	.85	.39	33%	63%	29%	77%
1,500	3.26	2.27	1.24	1.11	.61	1.68	.78	.83	.38	39%	76%	35%	93%
2,000	3.25	2.20	1.21	1.08	.60	1.61	.74	.79	.36	50%	102%	43%	126%
3,000	3.23	2.13	1.16	1.05	.57	1.54	.70	.76	.35	73%	155%	63%	190%

The collateral advantages, however, are all with the electric lights. The gas heats the room and vitiates the air. In the room in question it dried up the moisture from the vapor pots, an evil which a practical weaver will readily comprehend, as it causes the yarn to "kink." It discolors the ceilings, thus absorbing the light. These defects are all wanting with either of the electric light systems in question, and not only can better work be done, and larger production be obtained, but a manufacturer using the electric light is able to select from an abundance of help, and thus secure the best, while his gas-lit neighbor suffers from inferior workmanship, and a scarcity of laborers. But, possessing these advantages in common with the arc light, the Edison system goes further. Its light is absolutely steady, while every one is familiar with the flickering of the gas flame or arc lamp. Unlike the latter, shutting off lamps saves power in proportion, and should it be necessary to stop say four out of the twenty-four looms, it is not necessary to consume a horse-power for

the twenty which continue to run, as each Edison lamp may be turned off, entirely independent of the others, and one-seventh of the power will be saved. Again, on "dark days" it is necessary to light the centre of the room before the sides. The arc lamps named above being "in series" on one circuit, must be switched off each in turn, and then, with no saving in power, as it is impossible to shut off more than three-tenths of the lamps on those circuits without throwing in an equivalent resistance either by other lamps or resistance coils. On the other hand, the Edison lamps are arranged in several distinct circuits, each of which runs the length of the room, and parallel to the others. By switches the entire line may be shut off at once, with a resulting economy in power. An automatic regulator is provided which, as lamps are turned off in the rooms, inserts resistance in the magnet circuit (*not* in the direct circuit or the circuit in which the lamps are placed with the arc lights), thus allowing less current to pass around the magnets. These magnets, therefore, become weaker, and less power is required to turn the armature. The Edison is the only electric light company using an automatic regulator, whereby an absolutely steady, and uniform light is maintained irrespective of both the load and speed of the armature within reasonable limits; that is, it cannot produce light when the dynamo is at rest, nor entirely adjust should that speed be doubled. The former case is not expected, and the latter never occurs in practice. The fires, stated in the daily papers as being produced from the "electric light," have been due to the arc light; no insurance company has ever been called upon to pay a cent on account of damage by the Edison system. The reason is obvious. Edison uses an automatic safety device, which is absolute in its action. It acts on the same idea as the automatic sprinkler, and is even more sure. Only the one, or at most three lights, on the "tap" would be extinguished in case of an accident, as each tap is protected by its own safety-catch. The use of such an arrangement on an arc light circuit is theoretically possible, but it is utterly impracticable. The arc lights are, so to speak, strung along one wire, the current for the second passing through the first; any break in this circuit will instantly extinguish every one of the lights on the machine; a most serious objection, as a panic would inevitably ensue among the operatives. Again, break-downs on the looms usually occur below the lathe, and as the dense shadows cast by the arc lamp render repairs by its aid out of the question, oil lamps must be used to the great discomfort and disadvantage of the mechanics. Edison has a lantern which may be attached by means of a flexible cord to the socket over the loom or other machine. This lantern may thus be carried about within a radius of the length of the flexible cord. The lantern may be carried to any part of the room, and there made available about any machine by detaching it from one socket, and attaching it to another.

The current produced by the Edison dynamos is perfectly harmless, it being impossible to produce injury to the person by its passage through the

body. An ordinarily close reader of the daily papers cannot fail to have been struck with the number of accidents resulting from the use of the arc light or gas.

Thus, for cheapness in first cost, economy in running expenses, and general efficiency and desirability, as well as safety to the person and property, the advantage seems to be entirely on the side of the Edison system, as compared with the arc system or gas. Its superiority to either of the other systems is not confined to the illumination of weave shops; an equal advantage will be found in either the spinning, spooling, carding, or other departments of a cotton, woolen or worsted mill.

In machine shops, or other places where *special* light is required, the Edison system stands without a rival.

Mr. Edison has a larger machine which will produce a cheaper light even than the dynamo in the above example. This larger dynamo will produce and maintain current sufficient for 325 to 350 lamps of 16 candle-power each. The installation of this machine, together with all necessary material, will cost in the neighborhood of $5,500 or about $15.72 per lamp, against $16 per lamp for installation of dynamos in above example."

TESTIMONIAL FROM BOSTON CHAIR COMPANY. We have received the following testimonial from the Boston Chair Manufacturing Company, 86 Washington Street, Boston, Mass.:

"Boston, May 25, 1883.

Spencer Borden, Esq.,
Boston, Mass.

Dear Sir:—Your favor of 15th inst., asking for details of cost of running our Edison System of lighting and figures compared with other methods of lighting has been received. We commenced using the light late last winter, and continued to use it only till about 1st of April. We used one hundred and fifty lights, an average of one hour a day, for about one hundred days: and on account of the possible danger from fire in other methods of lighting we have never used any artificial light at all before introducing your system. We therefore cannot give you any figures of comparison. In regard to cost of running, it was almost inappreciable, our fuel being of no market value, our engineer and foremen being employed by the day of ten hours, and the light being required at the last hour of the day when machinery and shafting were well oiled, buildings warm, etc. We have not figured any cost except the services of one man at $2.50 per day, taken from his other duties one hour per day. While we used the lights the whole plant gave perfect satisfaction; no lamps gave out, none were broken except by our own carelessness during the day, nothing whatever went wrong.

Respectfully,
L. B. Adams, Supt."

STEAMSHIP LIGHTING. ANOTHER PLANT STARTED. The plant of 65 A lamps installed by the Edison Company of London on the "Rio Pardo," a steamship built for the Brazilian coasting trade, has been successfully put in operation. The vessel recently made a trial trip, lighted by its plant of Edison lamps in a most satisfactory manner.

EDISON ISOLATED PLANTS. FULL LIST. We print below a list of 334 Edison isolated plants, aggregating 65,145 incandescent lamps now in operation in this country and in other parts of the world. This list excludes all central station plants, and embraces only isolated plants, where the party using the light furnishes his own power and owns his own dynamo. It is with no little pride that we are able to state in connection with the publication of this list, first, that there has never been a fire or an injury in connection with any of our plants, and second, that we have never had a single installation rejected.

PLANTS IN MILLS, FACTORIES AND INDUSTRIAL ESTABLISHMENTS.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
American Bank Note Co.	New York City	Engraving	125
Arlington Mills	Lawrence, Mass.	Cotton and Woolen Mills.	130
Max Ams	New York City	Canning Factory	65
American Printing and Dye Works	Fall River, Mass.	Printing and Dyeing	250
Amory Manufacturing Co.	Manchester, N. H.	Cotton Mill	250
Alberton Cotton Mills	Elysville, Md.	Cotton Mill	250
American Oak Leather Co.	Cincinnati, Ohio	Tannery	150
Albion Paper Co.	Holyoke, Mass.	Paper Mill	150
Arnold Print Works	North Adams, Mass.	Print Works	150
R. H. & C. M. Avery	Peoria, Ill.	Agricultural Implements	142
Emil Ascherberg	Dresden, Germany	Piano Factory	230
Alferaki & Cie	Taganrog, Russia	Mill	80
Baldwin Locomotive Works	Philadelphia, Pa.	Machine Shops	75
D. F. Beatty	Washington, N. J.	Organs & Pianos	250
Boston Sugar Refinery	East Boston, Mass.	Sugar Refinery	125
Brooklyn Sugar Refinery	Brooklyn, L. I.	Sugar Refinery	80
Bourne Mills	Fall River, Mass.	Cotton Mills	540

PLANTS IN MILLS, FACTORIES AND INDUSTRIAL ESTABLISHMENTS.—Continued.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Boston Rubber Shoe Co.	Malden, Mass.	Rubber Shoes	60
Bridgeport Organ Co.	Bridgeport, Ct.	Organ Factory	500
Best Brewing Co.	Milwaukee, Wis.	Empire Brewery	506
Butters, Peters & Co.	Tallman, Mich.	Saw Mill	60
Boston Chair Co.	Ashburnham, Mass.	Chair Factory	150
Bay State Sugar Refinery	Boston, Mass.	Sugar Refinery	150
Batavia Paper Co.	Batavia, Ill.	Paper Mill	35
Bergmann & Co.	New York City.	Electrical Works	600
Ph. Barin	Coudé Moireau, Fr.	Thread Works	73
J. Bardou & Fils	Perpignan, France	Paper Mill	60
Boehmisches Brauhaus	Berlin, Germany	Brewery	120
Béliard & Best	Anvers, Belgium	Forge	34
Clark Thread Co.	Newark, N. J.	Thread Works	125
Carr & Hobson	Bergen Point, N. J.	Agricultural Implements	120
R. H. Coleman	Cornwall, Pa.	Smelting	60
Conanicut Mills	Fall River, Mass.	Cotton Mill	250
Clark & Keen	Philadelphia, Pa.	Woolen Mill	200
California Sugar Refinery	San Francisco, Cal.	Sugar Refinery	150
Ch. Colliard	Au Câteau, France	Weaving	120
M. Clerget	Vesoul, France	Canned Provisions	60
Cavalieri & Franco	Bologne, Italy	Mills	54
Benigno Crespi	Vaprio "	Cotton Mill	60
Crespi & Co.	Bergamo "	" "	120
G. Crespi & Co.	Vigevano "	" "	104
A. M. Crossi	"	" "	26
Cte St. Genois	Czelleckowitz, Aus.	Sugar Refinery	120
Cie. Fives Lille	Neusatz, Austria	Bridge Builders	12
Charbonnage du Presles	Farciennes, Belgium.	Coal Mine	60
Canadian Cotton Co.	Cornwall, Canada.	Cotton Mill	520
Danforth Locomotive Works	Paterson, N. J.	Locomotive Works	60
Alfred Dolge	Dolgeville, N. Y.	Piano Materials	126
P. Dandicolle Fils and Gaudin	Bordeaux, France	Merchants	60
Durkopp & Cie	Bielefeld, Germany.	Machine Shop	27
Dembitzky & Cie	Okoulooki, Russia.	Bag Factory	60
DeSmet & d'Hanis	Ghent, Belgium.	Thread Works	60
Eastman Dry Plate Co.	Rochester, N. Y.	Photographic Materials	60
Fall River Bleachery	Fall River, Mass.	Bleachery	145
E. & T. Fairbanks & Co.	St. Johnsbury, Vt.	Scales	60
Fiss, Banes, Erben & Co.	Philadelphia, Pa.	Worsted Mills	500
B. Fischer & Co.	New York City	Spice Mills	55
N. K. Fairbanks & Co.	St. Louis, Mo.	Lard Works	178
Fenel Frères	Pexonne, France	Pottery	80
Fille Cassanello fu Vietro	Pegli, Italy	Mill	53
Fischer & Seige	Possneck, Germany.	Thread Works	120
Fürss & Crotogies	Rostock, Germany	Saw Mill	34
Finlayson & Cie	Tammerfors, Russia.	Thread Works	650

PLANTS IN MILLS, FACTORIES AND INDUSTRIAL ESTABLISHMENTS.—Continued.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Germania Mills	Holyoke, Mass.	Woolen Mills	70
D. Goff & Sons	Pawtucket, R. I.	Braid Mill	60
Grinnell Mill	New Bedford, Mass.	Cotton Mill	800
Gouvy Frères	Homburg, Germany.		60
E. L. Godin & Fils	Huy, Belgium	Factory	60
James Harrison	Newburgh, N. Y.	Woolen Mill	126
Harder Knitting Co	Hudson, N. Y.	Knitting Mill	160
Heywood Bros. & Co	Gardner, Mass.	Chair Factory	300
Havemeyer & Elder	Williamsburgh, N. Y.	Sugar Refinery	900
Harrison, Havemeyer & Co	Philadelphia, Pa.	" "	360
Hannart Fréres	Wasquehal, France	Dye Works	80
Hutcheson & Cie	Moscow, Russia	Thread Works	110
George Hopwood	Birtles Dean, Eng	Manufacturer	120
The "Harrison" Patent Steam Steering Co	Salford, England	Machine Works	70
G. P. Ide, Bruce & Co	Troy, N. Y.	Collar and Cuff Factory	150
Ingerois & Cie	Ingerais, Finland	Paper Factory	60
Invasculae & Cie	Invasculae, Finland.	Mill	17
Mr. Johnson	Yvaskyla, Russia	Saw Mill	15
King Philip Mills	Fall River, Mass.	Cotton Mills	750
William Knabe & Co	Baltimore, Md	Piano Factory	60
Kern's Flouring Mill	Milwaukee, Wis	Flour Mill	80
Laurel Lake Mills	Fall River, Mass	Cotton Mills	400
Lockwood Co	Waterville, Me	" "	250
Lorraine Woolen Co	Pawtucket, R. I.	Woolen Mills	400
Lehigh Valley R. R. Co	Sayre, Pa	Car Shops	150
Loddé Fils	Paris, France.	Feathers	80
J. Luc	Nancy, France	Tannery	60
Ed. Lefebvre	Port Anthon, France.	Thread Works	60
Lapage & Cie	Louviers, France	" "	60
L. Lefebvre	Roubaix, France	" "	80
R. Loeffel & Cie	Blainville, France	" "	210
A. Laroche, Joubert & Motteau	Angoulême, France,	Machine Shops	60
Lemmann & Co	Turin, Italy	Cotton Mills	120
M. Labrador	Madrid, Spain	Machine Works	60
Enrique Lanz	Valparaiso, Chile	Flour Mill	60
Manhattan Railway Co	New York City.	Car Shops	125
McKee & Fuller	Catasauqua, Pa	Car Shops	120
Merrimack Manufacturing Co	Lowell, Mass.	Print Works	250
Merrick Thread Co	Holyoke, Mass	Thread Works	98
J. O. Mattheissen & Wiechers	Jersey City, N. J.	Sugar Refinery	300
McCormick Machine Co	Chicago, Ills	Harvesting Machines, &c.	130
Mill Creek Distilling Co	Cincinnati, Ohio	Distillery	60
Matteawan Manufacturing Co	Matteawan, N. Y.	Hat Factory	120
Merrick Thread Co., Mill No. 2	Holyoke, Mass	Thread Works	360
Miller Industrial School	Batesville, Va	School	400
Mount Vernon Co	Baltimore, Md	Cotton Mills	400

PLANTS IN MILLS, FACTORIES AND INDUSTRIAL ESTABLISHMENTS.—Continued.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Montreal Cotton Co	Valleyfield, Ca.	Cotton Mills	800
Mayall Rubber Co	Reading, Mass	Rubber Factory	150
R. Y. McAden	Lowell, N. C.	Cotton Mill	100
Motte & Maillassoux	Roubaix, France	Dye Works	80
M. Moehring	Frankfort, Germany		120
Mather & Platt	Salford, Eng	Engineers	1,000
D. Moseley & Sons	Manchester, Eng	India Rubber	1,000
Mill San Christobel	Santiago, Chile	Mill	30
Nathan & Dreyfus	New York City	Machine Shops	125
National Tube Works	McKeesport, Pa	Tubing	65
New England Pin Co	Winsted, Conn	Silk Mill	400
Norton, Brother & Co	Chicago, Ills	Flour Mill	60
Novelty Iron Works	Dubuque, Iowa	Iron Works	60
Nonantum Worsted Co	Newton, Mass	Worsted Mill	500
Giacomo Nissim	Pisa, Italy	Cotton Mill	60
Norddeutsche Raffinerie	Hambourg, Germany	Sugar Refinery	15
M. Nobel	Helsingfors, Russia	Forge	120
Old Kentucky Woolen Mills	Louisville, Ky	Woolen Mills	350
Pemberton Mills	Lawrence, Mass	Cotton Mills	375
Pottstown Iron Co	Pottstown, Pa	Iron	60
Peacedale Manufacturing Co	Peacedale, R. I.	Woolen Mill	250
Park Mount Cotton & Woolen Co., Limited	Lenni, Pa	Cottons & Woolens	60
Portage Straw Board Co	Akron, Ohio	Straw Boards	130
H. Pochet	Paris, France	Glass Works	24
Poudrerie de St. Chamas	St. Chamas, France	Powder Mill	60
A. Ponti	Solbiate Busto, Italy	Cotton Mill	120
N. Porta & Cie	Huy, Belgium	Smelters	60
Rittenhouse Manufacturing Co	Passaic, N. J.	Woolen Mill	65
H. J. Rogers	Appleton, Wis	Mills	300
N. Rosenfeld & Cie	Coepnick, Germany	Linoleum Factory	65
Roschke & Buchskiel	Zittau, Germany		17
Y. Reynvaan	Amsterdam, Holland	Flour Mill	73
M. Riecks	Helsingfors, Russia	Paper Factory	60
M. Rey Ainé	Ghent, Belgium	Thread Works	60
Robey & Co	Lincoln, Eng	Engineers	120
Seymour, Sabin & Co	Stillwater, Minn	Car Shops	250
Sperry & Barnes	New Haven, Conn.	Meat Packers	240
J. B. Stetson & Co	Philadelphia, Pa	Hat Factory	500
J. P. Squires & Co	E. Cambridge, Mass	Pork Packers	130
Slater Cotton Co	Pawtucket, R. I.	Cotton Mills	300
Sibley Manufacturing Co	Augusta, Ga	Cotton Mills	600
Sayles & Washburn	Mechanicsville, Conn	Woolen Mill	300
Stearns Manufacturing Co	Erie, Pa	Machine Shops	150
Star & Crescent Flouring Mills	Chicago, Ills	Flouring Mills	60
F. Shaw & Brother	Grand Lake Stream, Me.	Tannery	60

PLANTS IN MILLS, FACTORIES AND INDUSTRIAL ESTABLISHMENTS.—Continued.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
P. Schmidt & Fils	St. Dié, France	Hosiery	140
B. Sirven	Toulouse, France	Paper Factory	17
Schafer & Hauschner	Berlin, Germany	Fixtures	17
Société Strontianit	Ahlen "	Mine	60
W. Schroder & Cië	Crefeld "	Weaving	14
S. Huckels Sohne	Neutischem, Austria	Hat Factory	80
Schoeller & Cië	Crakawir "	Sugar Refinery	17
Société La Lys	Ghent, Belgium	Thread Works	60
Iwan Simonis	Verviers "	Thread Works	120
Sté Anonyme Niel on Ruppel	Anviers, "	Factory	34
James Taylor	Newburgh, N. Y.	Cloth Mill	125
Tingue, House & Co	Glenville, Conn	" "	130
H. K. & F. B. Thurber & Co.	Moorestown, N. J.	Canning Factory	60
Trenton Iron Works	Trenton, N. J.	Iron	75
O. N. Taylor	Ludington, Mich	Saw Mill	15
M. Tanacz	Yosefor, Russia	Sugar Refinery	140
United States Rolling Stock Co.	Chicago, Ills	Car Shops	126
United States Rolling Stock Co.	Urbana, Ohio.	" "	128
George Urban & Co	Buffalo, N. Y.	Flour Mill	60
B. Verity & Sons	London, England	Electric Light Fittings	65
Valdez Brothers	Buenes, Chile	Flouring Mill	60
Winona Mills	Winona, Minn	Flour Mills	70
Wamsutta Mills	New Bedford, Mass.	Cotton Mills	750
Worumbo Mills	Lisbon Falls, Me	Woolen Mills	650
Willimantic Linen Co	Willimantic, Conn	Linen Thread	60
Whiting Paper Co	Holyoke, Mass	Paper Mill	120
Wright, Turner & Son	Salford, England	Spinners	900
Warren Chemical Works	Hunter's Point, L. I.	Manufacturing Chemists	60
York Manufacturing Co	Saco, Me	Cotton Mill	750

PLANTS IN RESIDENCES, STORES, THEATRES, ETC.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Academy of Music	Chicago, Ills	Theatre	125
Aitken, Son & Co	New York City	Dry Goods	120
American Express Co	New York City	Express Co	250
American Express Co	Chicago, Ills	" "	250
George Andres	Kreuznach, Germany	Residence	17
Albisu Theatre	Havana, Cuba	Theatre	197
Bijou Theatre	Boston, Mass	Theatre	644

PLANTS IN RESIDENCES, STORES, THEATRES, ETC.—Continued.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
Belle Jardinieré	Paris, France	Stores	60
Banque de France	" "	Bank	63
Calumet Club	Chicago, Ills	Club House	64
Conseil Municipal	Paris, France		60
M. Chaveau	Toulouse, France	Café	80
Ch. Sabertie	Mazamet, "	Merchant	60
Chambre des Deputies	Bruxelles, Belgium		120
Consolidated Telephone Company	London, England	Offices	120
Archibald Coats	Paisley, Scotland	Residence	130
City and Guilds of London Technical College	London, England	College	200
Madame Cousino	Santiago, Chile	Residence	200
Cafe Gunsler	Melbourne, Australia	Restaurant	60
J. W. Doane, Marshall Field, Edson Keith, O. R. Keith.	Chicago, Ills	Residences	250
Davis & Proal	Baltimore, Md	Storage Batteries	120
Daily News Co	Chicago, Ills	Offices, &c	176
Everett's Hotel	102 Vesey St., N. Y.	Hotel	250
Erie Grain Elevator	Jersey City, N. J.	Elevator	202
Ecole des Beaux Arts	Rome, Italy	Museum	60
E. E. L. Co. (Limited)	Manchester, England	Offices, &c	90
Marshall Field & Co	Chicago, Ills	Dry Goods	65
N. K. Fairbanks	Chicago, Ills	Residence	65
First Nat'l Bank	Chicago, Ills	Bank	250
Ford's Opera House	Baltimore, Md	Theatre	350
Green Island Hotel	Lake George, N. Y.	Hotel	350
G. Gerbaud	Narbonne, France	Merchant	17
Ges. fur Electric Light	Cologne, Germany	Store	154
Gottschalk & Co	Manchester, Eng	Merchants	100
Hotel Everett	84 Chatham St., N. Y.	Hotel	130
Hotel Vendome	Boston, Mass	Hotel	63
Haverly's Theatre	Chicago, Ills	Theatre	637
Hôtel Continental	Paris, France	Hotel	60
Hôf Theâter	Dresden, Germany	Theatre	60
Holborn Restaurant	London, Eng	Restaurant	1,000
House of Commons	Westminster, Eng	Dining rooms and Library	150
House of Assembly	Cape Town, Cape of Good Hope	Parliament House	60
E. S. Jaffray & Co	New York City	Dry Goods	180
Jordan, Marsh & Co	Boston, Mass	" "	162
Konigl Residenz Theater	Munich, Germany	Theatre	500
A. W. Krasnapolsky	Amsterdam, Holland	Café	70
George S. Ladd	San Francisco, Cal	Agency	60
Light & Force Co	New York City	Storage Batteries	15

PLANTS IN RESIDENCES, STORES, THEATRES, ETC.—Continued.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
M. Lentovsky	Nischni Novgorod, Russia	Theatre	60
J. Pierpont Morgan	New York City	Residence	300
Minonk Coal & Coke Co	Minonk, Ills	Residences, &c	100
Metcalf Bros. & Co	Detroit, Mich	Clothing Store	175
Merchants Nat'l Bank	Chicago, Ill	Bank	60
Magasins du Bon Marché	Paris, France	Stores	2,500
Magasins du Louvre	" "	"	60
Maier Loewi Frères	Passau, Germany	Residence	21
Musée du Nord	Bruxelles, Belgium	Museum	100
M. D. Mills	Chicago, Ills	Residence	231
National Life Insurance Building	Chicago, Ills	Insurance	130
Prospect House	Blue Mountain Lake, N. Y.	Hotel	125
Palmer House	Chicago, Ills	Hotel	84
C. W. & E. Pardridge & Co	" "	Dry Goods Stores	310
Post Office, &c	Watertown, N. Y	Stores, &c	60
Post Office and Depot	Stuttgart, Germany	Post Office, &c	1,000
F. de Puskas	Pest, Austria	Agency	285
Ressource	Berlin, Germany	Club	60
"Royal Institution"	Manchester, Eng	Picture Gallery	80
H. D. Smith	Appleton, Wis	Residences, Factories, &c.	250
St. Charles Hotel	New Orleans, La	Hotel	150
State House	Boston, Mass	House of Representatives	60
P. B. Shaw	Williamsport, Pa	Stores, &c	60
T, Taylor Smith	Enfield, England	Residence	65
H. K. & F B. Thurber & Co.	New York City	Wholesale Groceries	330
Spencer Trask & Co	Albany, N. Y	Bankers	15
Theatre de Brünn	Brünn, Austria	Theatre	860
Theater du Parc	Bruxelles, Belgium	"	500
Theater Royal	Manchester, Eng	"	500
University of Missouri	Columbia, Mo	College	60
U. S. Military Academy	West Point, N. Y	Academy	60
Union Club	Berlin, Germany	Club	225
Union Rau Geselschaft	Vienna, Austria	Restaurant	350
William Vogel	Munich, Germany	Restaurant	84
Von der Heydt	Elberfeld, "	Residence	120
J. Hood Wright	Fort Washington, N. Y	Residence	240
Western Edison Light Co	Chicago, Ills	Agency	250
R. H. White & Co	Boston, Mass	Dry Goods	750
Wilshire Building	Cleveland, Ohio	Offices, &c	400
Prof C. A. Young	Princeton, N. J	College	30
A. C. Yates & Co	Philadelphia Pa	Clothiers	250

PLANTS IN NEWSPAPER AND PRINTING OFFICES.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
A. S. Abell & Co	Baltimore, Md	*The Sun*	150
Advertiser Building	Boston, Mass	*Daily Advertiser*	173
James Gordon Bennett	New York City	New York *Herald*	500
W. Büxenstein	Berlin, Germany	Printer	60
George W. Childs	Philadelphia, Pa	*Ledger* Building	250
Diario de la Marina	Havana, Cuba	Newspaper	65
Gazette Publishing Co	Davenport, Iowa	Davenport *Gazette*	120
Gazette de Cologne	Cologne, Germany	Newspaper	120
Hinds, Ketcham & Co	New York City	Printers	240
Hachette & Cie	Paris, France	Publishers	60
A. Lahure	Paris, France	Printer	60
Morning *Herald*	Sydney, New South Wales	Newspaper	60
Manchester *Guardian*	Manchester, Eng	Newspaper	120
Ohio State Journal	Columbus, Ohio	Newspaper	60
R. M. Pulsifer & Co	Boston, Mass	Boston *Herald*	150
Record Room	Washington, D. C	Gov't Printing Office	125
Rand, McNally & Co	Chicago, Ills	Publishers	130
Record Building	Philadelphia, Pa	Newspaper	250
Weed, Parsons & Co	Albany, N. Y	Printers	450

PLANTS ON STEAMSHIPS, ETC.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
John D. Adams	Little Rock, Ark	Steamer "Kate Adams"	120
James Gordon Bennett	New York City	Yacht "Namouna"	120
Baltimore Steam Packet Co	Baltimore, Md	Steamer "Carolina"	126
" " " "	" "	" "Virginia"	120
Brazilian Steamship Co	London, England	S. S. "Rio Pardo"	65
" " "	" "	" " "Rio Parana"	65
Compagnie La Plateuse	" "	" " "Apollo"	180
" " "	" "	" " "Minerva"	180
Clan Line	" "	" " "Clan Macarthur"	150
Fall River Line	Fall River, Mass	Steamer "Pilgrim"	910
ay Gould	New York City	Yacht "Atalanta"	60
Kaukas, Mercure & Cie	Sur La Volga, Russia	Steamer	80
New York & Norwich Line	New London	S. S "City of Worcester"	325
Oregon Railway & Navigation Co.	Portland, Oregon	Steamship "Columbia"	120
" " " " "	" "	S. S. "Queen of Pacific"	250
Oceanic Steamship Co	San Francisco, Cal	Steamship "Alemeda"	210
" " "	" " "	Steamship "Mariposa"	150
Royal Navy	England	H. M. S. Troopship "Malabar"	373
Tasmanian Steam Navigaton Co	London, England	S. S. "Pateena"	150

PLANTS ON STEAMBOATS, ETC.—Continued.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
U. S. Fish Commission..........	Washington, D. C...	Steamer "Albatross"....	150
Union S. S. Co. of New Zealand...	London, England....	S. S. "Tarawera".......	150
Union S. S. Co. of New Zealand...	" "	" " "Waihora".......	150
Union S. S. Co. of New Zealand...	" "	" " "Takapuna"......	500
Williams & Guion...............	Liverpool, England..	Steamship "Oregon"....	150

PLANTS IN RAILWAY STATIONS, ETC.

NAME.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
American Ship Building Co.	Philadelphia, Pa....	Ship Yards..............	350
Messrs. Apesteguia.............	Cienfuegos, Cuba....	Sugar Estate............	84
Compagnie de l'Ouest...........	Paris, France........	R. R. Station	221
Ch. de fer Alsace, Lorraine	Strasbourg, Germany	R. R. Station...........	1,200
Chantier Imperial...............	Dantzig, Germany...	Dock Yard.............	200
Ch. de fer Koursk Kieff..........	Konotop, Russia....	R. R. Station..........	120
L. & S. W. Railway Co..........	London, England....	Waterloo Station........	200
Montalvo & Bros................	Cienfuegos, Cuba....	Sugar Estate...........	113
Oregon Railway & Navigation Co.	Portland, Oregon....	Steamship Docks........	120
Don Felipe de Pelayo...........	Cuba...............	Sugar Estate...........	72
State Prison.....................	Anamosa, Iowa.	Prison..................	216
Wilhelm Strasse..........	Berlin, Germany. ...	Street Lighting..........	250
Steamship Docks................	Lota, Chile.........	Docks..................	60
Count de Casa Ybanez....	Cuba...............	Sugar Estate...........	102
" " " "	Sierra Morena, Cuba	Sugar Estate.......	65

TOTAL NUMBER OF PLANTS....................	334
TOTAL LAMPS................................	65,145

WATER GAS PROHIBITED IN MASSACHUSETTS. Water gas is prohibited in Massachussets by the Statutes of the State. The law was originally passed on the report of officials and experts setting forth the danger to health and life in the use of water gas in buildings. The prohibitory clause providing that no gas shall be manufactured or used containing "more than 10 per cent. of carbonic oxide" is contained in Sect. 14, Chap. 61, Tit. 12, Public Statutes of Massachusetts.

WATER GAS VERSUS COAL GAS. A correspondent in the *American Gas Light Journal,* May 2d, writes as follows of attempts now being made by a certain water gas organization to "fleece gas companies":

> "If I am correctly informed a gas opposition crowd have banded together to raid the different gas companies of this country in the shape of opposition works, and the usual sell-out, compromise, or divide process; in fact, practicing a sort of lawful piracy on the knock-down and drag-out order. This company is known as the United Gas Improvement Company of Philadelphia, Pa.; and its representatives are before the councils of half a dozen cities, seeking rights, etc. They claim the water gas process, and will dicker anyhow to get at the cash-boxes of gas companies doing legitimate trade. I write this to suggest to the coal gas companies the prudence of combining for purposes of defence."

COAL GAS VERSUS WATER GAS. The London *Journal of Gas Lighting,* April 17th, referring to the Philadelphia *Water Gas Journal,* published "in the interest of water gas speculators," and speaking of the "war" between water gas and coal gas, says:

> "In the second number of the publication in question, the war is prosecuted with a vengeance. There is an article entitled 'Asking for the Repeal of an Infamous Law,' which, on perusal, we find to be an enactment of the State of Massachusetts, to the effect that gas containing more than 10 per cent. of carbonic oxide shall not be sold in the State. Most people who are not 'selfish and impertinent monopolists'—to quote a phrase in the article which is capable of other application than the writer intended—will wonder why an apparently benificent restriction on the sale of a poisonous gas should be thus qualified. This is the way our young contemporary disposes of the subject:—'No person, scientific or otherwise, has ever pretended to give any reason why water (the purest element in nature) should make the coal and oil parts of the gas more poisonous than the miserable stuff hitherto sold in nine-tenths of the towns and cities of this country.' Upon the question of carbonic oxide the water gas people are, of course, very sore; and the mere mention of it as a poison excites the new journal—we were about to say to a hydrophobic frenzy; but upon consideration, it appears that hydrophobia is, in their eyes, the fatal malady of coal gas enthusiasts. A great portion of this second number is made up of reprints of experts' opinions to show that carbonic oxide is rather a balmy compound than otherwise. It is tacitly admitted that the question of carbonic oxide poisoning is the rock upon which water gas schemes are apt to split, and their advocates are evidently driven to their wits'

end by the timely publication of a list of about a hundred cases of death by gas poisoning in the water gas lighted districts of New York and Brooklyn. Facts are stubborn things; and all the array of chemists and philosophers who may be induced, for a consideration, to swear that carbonic oxide is, in their opinion, not an objectionable ingredient in illuminating gas, will not remove the disagreeable impression created by one plain verdict of a coroner's jury. We fear that these hundred fatalities will continue to lie heavily on the *Water Gas Journal*."

WATER GAS FORBIDDEN BY LAW IN NEW JERSEY. The Statutes of New Jersey prohibit the use of water gas. The date of the original prohibitory law was March 8th, 1877, and the prohibitory clause, forbidding the use of gas "containing more than two per centum of carbonic oxide gas," can be found on page 1342, Revised Statutes of New Jersey.

No. 19.
AUG. 15, 1883.

NINETEENTH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE, NEW YORK.

August 15th, 1883.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

CONTENTS.

FIRST DISTRICT, NEW YORK CITY. This plant still runs with entire success, being now in its twelfth month of continuous operation, without a stop, even for a minute. Nearly all the customers the station can safely supply are now connected, and we are making no new connections, save in exceptional cases where lights are burned either for many consecutive hours during the day or all night. The meter works perfectly, and our customers continue to be satisfied both with the price of the light and the light itself. We are at present lighting 431 houses, wired for about 10,300 lamps.

MR. JAY GOULD'S YACHT LIGHTED. A plant of one L dynamo, with a capacity of 150 A lamps, has been installed on Mr. Jay Gould's new yacht, the "Atalanta." The dynamo is driven by a 6½ x 8 Armington & Sims engine, located in the engine room, on the starboard side of the vessel. The main conductors for the light run fore and aft, in four distinct circuits. There are 116 lamps installed in the interior of the vessel, placed as follows:

Social Hall - - - - - -	11	Lamps
Dining Saloon - - - - -	20	"
State Room Toilets - - - - -	11	"
Passage Ways - - - - -	8	"
Mr. Gould's Private Room - -	4	"
Private Bath Room - - - -	1	"
Engine and Fire Rooms - - - -	23	"
Shaft Alley - - - - - - -	3	"
Pantry - - - - - - - -	2	"
Captain's Room - - - - -	4	"
Mess Room - - - - - - -	4	"
Kitchen - - - - - - -	4	"
Miscellaneous - - - - -	21	"
Total - - - - -	116	"

There are also three 32 candle-power lamps enclosed in a Fresnal globe, which serves for the mast-head lantern. This, together with the red and green sailing lamps on the port and starboard sides, each of which is lighted by two 32-candle lamps, are entirely new features in steam-ship lighting.

NEW YORK. FERRY BOAT TO BE LIGHTED. We have received an order for a plant of one Z dynamo and 60 A lamps, to light the ferry-boat "Fanwood" belonging to the Central Railroad Company of New Jersey.

BOSTON. PLANT FOR CHICKERING & SONS. We are installing a plant of one L dynamo and 174 A lamps in the piano show rooms and music hall of Messrs. Chickering & Sons, Boston, Mass.

NEW BEDFORD, MASS. PLANT FOR CORD WORKS. We are installing a plant of one L dynamo and 160 A lamps in the works of the New Bedford Cordage Company, New Bedford, Mass.

A NEWSPAPER PLANT INCREASED. BOSTON. Messrs. R. M. Pulsifer & Co., (The *Boston Herald*), have enlarged their plant by the addition of one H dynamo, 350 lamps, thus making the total capacity of their plant 500 A lamps. This increase was ordered after trial of an infringing lamp which had proved to be unsatisfactory.

BOSTON. TESTIMONIALS FROM STATE HOUSE. We print below letters received from the Speaker of the House of Representatives, and the Chief Engineer of the State House, Boston, in regard to the Edison plant installed there:

"Commonwealth of Massachusetts,
House of Representatives,
Boston, July 20th, 1883.

Mr. Spencer Borden,
Manager New England Department,
Edison Electric Light Co.

Dear Sir:—In reply to your favor of 18th inst. in reference to the light used in the House of Representatives, State House, Boston, I would say that I have nothing but commendation for same. I have not heard the slightest adverse criticism. The members have been highly pleased with the brilliant yet agreeable illumination of the House during the session. The light seems strong and penetrating, yet is soft and does not dazzle the eyes. Last year an arc light Company attempted to light the same room but the light furnished by them was very unsatisfactory on account of its unsteadiness and dazzling rather than illuminating properties. I consider your light superior to any other artificial illuminant I have seen; it does not heat nor vitiate the air as did the gas, which on cloudy days and during night sessions rendered the atmosphere almost unbearable. I cannot but congratulate you, and through you the Company you represent, on their unqualified success.

Yours truly,
Geo. A. Marden,
Speaker of the House."

The following is the letter from the Chief Engineer of the State House, Boston, who has charge of the Edison plant, above referred to:

"State House,
Boston, Mass., July 20th, 1883.

Mr. Spencer Borden,

Dear Sir:—In your letter of yesterday you ask me in regard to the working of the system of electric lighting which your company installed in the State House last winter. I have had charge of the same since its start, and have found that it requires very little attention. After starting the dynamo, no care is required beyond keeping the oil cups on the pillow blocks full. The automatic regulator takes care of the rest, and does its work to perfection. Should the number of lights in use be suddenly increased or as suddenly decreased, this instrument acts instantly. I consider it one of the most valuable features in your system. The members have been frequent visitors in the dynamo room and have been much pleased with the efficiency of the system. The dynamo shows no depreciation. In conclusion, I would say, that the operation of the system is about as near perfect as I can conceive it possible to have it.

Respectfully,
George E. Stafford,
Chief Engineer."

THE EDISON LIGHT AT THE RAILWAY EXPOSITION, CHICAGO. The following extract, relating to the Edison light at the Exposition of Railway Appliances recently held at Chicago, is taken from the *Scientific Times*, July 21st:

"Many of the most important displays made at the Exposition were not placed in the competitive list, as the main object of their inventors and owners was to place them before the public and give the public an opportunity to judge for themselves with respect to their several merits. Many of the exhibits also belonged to the class of thoroughly tested and well-known systems and appliances, of acknowledged standard excellence, which stand each at the head of its class. Such is the character of the celebrated Edison Incandescent Electric Light, whose former success, supplemented by the victory at the Exposition, renders it certain that this system is the most practicable yet discovered for illuminating by electricity. One hundred and fifty of those lamps were placed under the water and spray of the great fountain and produced an enchanting effect. The peculiarly brilliant but mellow light gained for it many friends; in fact no unprejudiced person could hesitate for a moment in declaring his preference for the Edison system both with clear and colored lamps. The arc systems in operation concentrated the light into one small spot of intense brilliancy, constantly scintillating and changing colors, always trying and often very injurious to the eye. The incandescent system, on the contrary, is a soft, steady light, bright as the best quality of gas light, and very pleasant to the nerves of the eye. It seems to diffuse the light without first concentrating it. This is the principle upon which Mr. Edison's celebrated incandescent electric light is constructed. It is especially adapted for industrial or domestic purposes."

ANAMOSA PENITENTIARY. ANOTHER TESTIMONIAL. The following is a copy of a report made by Mr. A. E. Martin, Warden of the Iowa Penitentiary, where an Edison plant is in use. This report goes first to the Iowa Commissioners and from them to the Governor and Legislature. The report is as follows:

"Warden's Office, Penitentiary,
A. E. Martin, Warden.
Anamosa, Iowa, July 12th, 1883.

Western Edison Light Co.,
53 Wabash Avenue, Chicago, Ill.

Since June 1st, we have kept an accurate account of the fuel consumed by weighing all the fuel used each day during the month of June.

We have run our dynamo 30 days, using 143 lamps 29 and one-half hours in the 30 days, consuming for this use 3,281 of fuel, with the following result: For 5 days we used the best Southern Illinois coal, running 5 and three-quarters hours in the 5 days and using 386 of coal, which gives an average of 77.2 per day, at a cost of $3.70 per ton makes the cost per day $0.14282, or per hour the amount consumed is 67,13 which at the $3.70 per ton, gives the cost as $0.12419.

For 16 days, we used common Illinois coal, running 15 and three-quarter hours in the 16 days and used 1,356 of coal, an average of 84.75 per day, which at $3.70 per ton, gives the cost per day $0.15679, or per hour the amount of coal used was 86,09, and the cost per hour $0.15926.

For nine days we used slack from common Illinois coal, running 8 hours in the nine days and used 1,539 of slack, at an average of 171 per day, which at a cost of $1.95 per ton, makes the average cost per day $0.1667, or per hour the amount of slack used was 192.125, and the cost per hour $0.18732.

RECAPITULATION.

143 lamps run during the month of June 1883.

5 days at $0.14282,	$0.7141
16 days at $0.15679,	$2.5085
9 days at $0.16672,	$1.5004
30	$4.7230

Average cost per day $0.15743.

143 lamps run during the month of June 1883.

5 days 1.15 hours per day,	5.75 hours.
16 days .984 hours per day,	15.75 hours.
9 days .889 hours per day,	8.00 hour
30	29.50

143 lamps used 29.5 hours costs $4.723 gives 16 cents as the cost per hour for the whole number, and the cost per lamp for one hour $0.001,118, cost of lamp $1.00, life of lamp 600 hours.

Cost per hour . . . $0.001333
Total cost per lamp per hour - $0.002451

We have 220 lamps, which if all had been used, would have reduced the average cost per lamp.

When candles and oil are used, the cost per hour was .552, comparing this with the .16 per hour, the cost of electric light, the economy of the latter is readily seen, but the whole advantage or gain is not in the actual cost alone, but the quality of light in present use is greatly superior to that of candles and oil.

Respectfully,
A. E. MARTIN,
Per L. PEARSON."

CORNWALL, PA. TESTIMONIAL. The following letter refers to one of our plants which has been in operation over a year, and affords gratifying evidence of the satisfaction given by the light:

"CORNWALL, LEBANON CO., PENN., JULY 30th, 1883.
EDISON CO. FOR ISOLATED LIGHTING,
65 Fifth Ave., N. Y. City.

GENTLEMEN:—The light furnished by your plant at my Cornwall office and furnaces is so satisfactory that I have determined to investigate the cost of a similar plant for my house, stable and grounds. * * *

Yours truly,
ROBERT H. COLEMAN."

PITTSBURG, PA. A NEWSPAPER PLANT. We have received an order from Mr. Robert P. Nevin, proprietor of the *Pittsburg Times*, for a plant consisting of a small dynamo and 25 A lights.

BENEFICIAL EFFECT ON THE EYESIGHT OF THE INCANDESCENT LIGHT. We take the following paragraph from the *Medical Record*, New York, July 21st:

"In discussing the value of any particular source of artificial light, says Professor Mauthner (*Wien. Allgem. Med. Zeit.*, No. 10, 1883), three qualities should be especially regarded: 1, steadiness of the light; 2, the strength of the light; 3, its composition. From its complete failure in point of steadiness, the arc-light must be at once rejected from the category of lights suitable for the human eye. The incandescent lamp, on the other hand, deserves a prominent position. As regards its strength or intensity, it also fulfils all requirements, since it can be modified or intensified at will. The composition of the lights habitually used hitherto has shown a preponderance of yellow rays. In the electric light, however, the short-wave rays predominate, i. e., the violet rays. To the human retina, blue or violet tints are more agreeable than yellow, and hence from its composition, as well as from its steadiness and adaptibility, the light of the incandescent lamp is especially adapted for the use of the human eye. Distinctness of vision and the perception of color are both increased under the electric light, facts which might be theoretically held to involve an overstrained retina. Such a theory is not, however, borne out by practical experience; it is only where the light

employed is unsteady that any ill effects have been observed. It may be considered as an established axiom, that the brilliancy and composition of any light are as nothing, in respect of its value as an illuminating medium for ordinary uses, compared with its constancy and steadiness. In the incandescent lamp no combustion takes place, and hence no consumption or vitiation of atmospheric air is induced. From a theoretic point of view, therefore, no objection can be raised against the use of the incandescent electric lamp. Its full value as an illuminator is, however, not yet ascertained."

CAMPECHE, MEXICO. TESTIMONIAL. We have received the following testimonial from Messrs. Detmold & Co., manufacturers of logwood extracts, near Campeche:

"LAGUNA DE TERMINOS, MEXICO, June 15th, 1883.

TO THE EDISON ELECTRIC LIGHT CO.,
New York.

GENTLEMEN:—The Electric light plant, consisting of an 8¼ x 10 inches Lawrence engine, and an L dynamo-electric machine, with wires and fixtures for 125 lights, which we obtained from you through Messrs. Maitland, Phelps & Co., of your city has been established in our factory by Mr. Geo. W. Waters, the engineer you sent out for the purpose, and we have the satisfaction to state that the whole plant works admirably well and that your system of lighting is the most perfect, economical and easy to manage we know of. Most probably, it will be adopted, before long, for lighting the principal streets and private dwellings in our town.

We are, gentlemen,
Your most obedient servants,
DETMOLD & CO."

LAKE GEORGE, N. Y. HOTEL LIGHTED. The following letter was received by our Philadelphia agent from the Manager of the Sagamore Hotel, Green Island, Lake George, where we have recently installed a plant of 350 lights:

"BOLTON, N. Y., July 14th, 1883.

JOHN HOSKIN, Agent,
Room 6, Ledger Building, Philadelphia.

DEAR SIR:—The Electric lights are running very satisfactorily. Every one is delighted with them.

Yours truly,
M. O. BROWN, Manager."

DAVENPORT "GAZETTE" AGAIN. TESTIMONIAL. The following is a testimonial received from the Davenport *Gazette*, which is supplied with the Edison light from a small central station at Davenport:

"DAVENPORT, IOWA, June 4th, 1883.

TO THE WESTERN EDISON LIGHT CO., Chicago.

GENTS:—The Edison electric light has been in constant use by the Davenport Gazette Company for more than six months. It has been so used in lighting the business office, editorial rooms, news-composing rooms, job office, press, engine and boiler rooms, in a word, the entire *Gazette* establishment, to the exclusion of all other lights.

Besides, the plant of the Davenport Electric Light Company, from which the *Gazette* is supplied, furnishes the Edison light also to the Post Office, the Ackley House, the hat store of W. S. Cameron & Son, the wholesale tobacco warehouse of N. Kuhnen, and the wholesale and the retail clothing store of R. Krause, one hundred fifty sixteen-candle lamps in all. The result of this continued use has been not only entirely satisfactory but particularly gratifying. The light is readily and constantly maintained at a uniform brilliancy and illuminating power. Its use is found to be pleasant and soothing to the eye, so that the night editor, proof-reader and compositors are enthusiastic in its praise.

It is the opinion of experienced compositors that an average of 10 per cent. more type can be set up at night under the Edison light than under light from gas, and with much less weakness to the eye. Personally, I can testify after working on an average of at least five hours per night under the Edison, that eyes which had for months previous been much irritated and sore under similar work by gas light have healed and grown strong.

All persons here using the Edison are delighted with its efficiency of service, its regularity and evenness of volume and the softness of its brilliancy. It is 'the light of lights' in our esteem.

Yours respectfully,
EDWARD RUSSELL,
Editor."

LONG LIFE OF EDISON LAMPS. We have received the following letter relating to an Edison plant in use in the mill of Messrs. Clark & Keen, Philadelphia:

"PHILADELPHIA, June 26th, 1883.

JOHN HOSKIN, Esq.,

AGENT EDISON CO. FOR ISOLATED LIGHTING,

DEAR SIR:--Yours 23d inst. to hand. Lamp record to Saturday, June 23d is as follows:

Hours run	1,522
Lamps burning	120
Lamps broken	47

Yours, &c.,

CLARK & KEEN."

The above statement shows an *average* life of our lamps at this establishment of 3,886 hours, being 3,286 hours in excess of our guarantee.

TESTIMONIAL FROM EMPIRE BREWERY, MILWAUKEE. We have received from the Western Edison Light Company the following testimonial relating to an Edison plant in the Empire Brewery:

"MILWAUKEE, WIS., June 2d, 1883.

WESTERN EDISON LIGHT COMPANY,

51 & 53 WABASH AVE., Chicago, Ill.

GENTLEMEN:—The Edison electric light with which our Empire Brewery and the buildings connected therewith is provided, has been in actual operation for the last five months, and, it affords us pleasure to state, has proved entirely satisfactory. The experience and observation we have gained during that time justify us in expressing the opinion that for our purpose this system is decidedly superior to that of the gas light, and we hereby gladly recommend it as such.

Yours very truly,

PHILLIP BEST BREWING CO.,

By CHAS. BEST, Sec'y."

PEORIA, ILL. TESTIMONIAL. The following letter has been received by the Western Edison Light Company:

"Office of R. H. & C. H. AVERY,
MANUFACTURERS OF CORN PLANTERS, &C.

PEORIA, ILL., July 18th, 1883.

WESTERN EDISON LIGHT CO.,

Chicago, Ill.

GENTLEMEN:—We have been using with great satisfaction the plant which you put in our factory last winter—a portion of the time running all night with very little expense; no danger from fire and all the light we need; and at the benches or machinery, just where we most need it, find a very great convenience.

In fact we know of no artificial light we would exchange it for.

Yours truly,

R. H. & C. H. AVERY."

AUGUSTA, GA. ANOTHER COTTON MILL TO BE LIGHTED. We have received an order from the Enterprise Manufacturing Company to light their Cotton Mill at Augusta, Ga., with a plant of two dynamos and 550 A lamps.

TESTIMONIAL FROM A PIANO FACTORY. We have received the following testimonial from Messrs W. Knabe & Co., who are using an Edison plant in their piano factory:

"BALTIMORE, June 4th, 1883.

EDISON CO. FOR ISOLATED LIGHTING.

65 Fifth Ave., New York.

DEAR SIRS:—In reply to your favor we are glad to say that the Edison light has given perfect satisfaction. We are using 150 B lights from your Z dynamo since last November in our case-making department, where we formerly permitted no light whatever, not wishing any risk from gas jets or the use of matches in lighting same. The dynamo runs direct from shaft of fly which makes 58 revolutions per minute, the light being very steady, without the least flickering; your arrangement of flexible tubes is a very ingenious one and the workmen are delighted. The breakage of lamps has been altogether but very trifling and mostly by carelessness, and the entire time required of engineer for attention to dynamo not over 15 to 20 minutes each evening. We cheerfully recommend the light to every manufacturer, being as near perfect as any can possibly be. With best wishes.

Yours very truly,

W. KNABE & CO."

NEWBURGH, N. Y. ANOTHER TESTIMONIAL FROM MR. JAMES HARRISON. We quote below a letter received by one of our agents, Mr. Charles T. Hughes, from Mr. James Harrison, in whose mill an Edison plant has been in use since September 28th, 1881:

"Office of THE ORANGE CO. WOOLEN MILLS,
NEWBURGH, N. Y., June 12th, 1883.

MR. CHARLES T. HUGHES,

DEAR SIR:—In reply to your inquiries I will say that the longer I use my Edison light the better I am pleased with it. The fact of the matter is I cannot say too much in its favor. It is cheap, it gives a good light, by which colors (including green and blue) can be distinguished at night by its aid, and last but not least, it is absolutely safe. If you should ever organize a company in this city, I would thank you to give me an opportunity to become a member of it.

Yours, &c.,
JAMES HARRISON."

DAVENPORT, IOWA. TESTIMONIAL. The following letter has been received by the Western Edison Light Company in regard to the Edison plant operated by the Davenport Electric Light Company:

"DAVENPORT ELECTRIC LIGHT CO.
DAVENPORT, June 8th, 1883.

WESTERN EDISON LIGHT CO.

GENTLEMEN:—In answer to your favor of 6th inst. I take pleasure in saying that this company has had in operation since January last an Edison light plant consisting of a six-by-eight and one-half Armington & Sims engine, and a 150 sixteen-candle light dynamo.

The plant has worked perfectly since its installation.

Light is supplied from it to the Davenport *Gazette*, Post Office, Ackley house, W. S. Cameron & Son, hat store, N. Kuhnen's tobacco factory and R. Krause's wholesale and retail clothing house.

The light is giving perfect satisfaction and is preferred to gas or any other illuminant.

The light is sold cheaper than the prevalent rates for gas here and is paying a *good* profit on the investment, so that we are more than satisfied with the enterprise.

Yours sincerely,
WM. RENWICK, Treas."

LAKE GEORGE, N. Y. HOTEL LIGHTED. The plant at the Sagamore Hotel, Green Island, Lake George, which was mentioned in the last Bulletin, has been installed and is now in operation. The plant consists of one H dynamo with a capacity of 350 A lights, the motive power being supplied by a 9½ x 12 Lawrence engine. The boiler, engine and dynamo are placed in the engine room, which is situated about 350 feet from the hotel, to which the current is carried by outside conductors. The distribution of the lamps is as follows:

172	Lamps in	Sleeping Rooms, one lamp each.
42	"	Halls.
12	"	Billiard Room.
3	"	Bar Room.
6	"	Office.
12	"	Main Entrance.
12	"	Main Parlor.
6	"	Private Parlors.
33	"	Dining Room.
3	"	Private Dining Room.
10	"	Porches.
13	"	Kitchen and Laundry.
45	"	Closets, Bath Room, Barber Shop and miscellaneous places.
Total, 369	lamps.	

CONTRACTS CLOSED BY THE WESTERN EDISON LIGHT COMPANY. Since the last Bulletin, the following plants have been sold by the Western Edison Light Company:

(1). A plant of two K dynamos and 640 A lamps, to light the retail dry goods establishment of Messrs. Mandel Brothers, Chicago, Ills.

(2). A plant of one Z dynamo and 60 A lamps, for the flour mills of Messrs. E. Sanderson & Co., Milwaukee, Wis.

STEAMSHIP LIGHTING IN EUROPE. An order has been received by the English Edison Company to light the steamer "Clan McIntosh" of the Clan Line, with one L dynamo and 150 A lamps. This is a sister ship to the "Clan MacArthur" which was lately fitted up with our light. The owners were so pleased with the success of the light on the latter vessel that they gave the order to light the "Clan McIntosh" with Edison lights without inviting tenders from any other electrical companies.

U. S. NAVY. STEAMSHIP LIGHTED. A plant of one L dynamo and 150 A lamps is being installed on the United States Steamship "Trenton," now at the Brooklyn Navy Yard.

SAN FRANCISCO. STEAMSHIP LIGHTED. We are installing a plant of one dynamo and 100 A lamps on the Steamer "Kinau," which is to run between San Francisco and the Sandwich Islands. This steamer belongs to the Oceanic Steamship Company, and is now being built at Philadelphia by Messrs. W. Cramp & Sons.

PORTLAND, OREGON. STEAMSHIP LIGHTED. We have received an order from the Oregon Railway & Navigation Company to install a plant of one L dynamo and 300 B lamps on their steamer "Alaskian."

BUFFALO, N. Y. FLOUR MILL TO BE LIGHTED. We are installing in the flour mill of Messrs. Thornton & Chester, Buffalo, a plant of one Z dynamo and 60 A lamps.

ATLANTA, GA. COTTON MILL PLANT. We are installing a plant of one H dynamo and 350 A lamps in the Exposition Cotton Mill, Atlanta, Georgia.

AUGUSTA, GA. COTTON MILL TO BE LIGHTED. We have received an order from the John P. King Mill Company for a plant consisting of two dynamos and 765 A lamps, to be installed in the King Mill, Augusta, Georgia.

BALTIMORE, MD. PRINTING-HOUSE PLANT. An order has been received from Messrs. William J. Hooper & Sons, (the *Herald* Publishing Co.), Baltimore, for a plant of one L dynamo, 100 A and 100 B lamps, to light their printing establishment.

PORTLAND, OREGON. TRANSFER BOAT TO BE LIGHTED. We have received an order to light the transfer boat "Kalama," belonging to the Northern Pacific Railroad Company, with one Z dynamo and 60 A lamps.

EDISON FIRE ALARMS IN HOTELS. An ingenious device has been arranged in connection with the circuits of the Edison Central Station in Santiago, Chili. There are four hotels in the district lighted, and in each of them is being introduced a series of fire alarms. In addition to the lamp or lamps used to light the bedrooms, another lamp has been placed near the ceiling of each room, so as to be out of reach of the occupant, while other lamps are arranged in the halls and at the exits. Electric bells are also placed in the halls. The whole of these lamps and bells are embraced in one circuit which terminates in a switch placed in a recess in the wall in some conspicuous place. This recess is covered by a pane of glass to protect the switch from careless or malicious use. In case of a fire breaking out in the hotel this pane of glass is to be broken and the switch closed, thereby lighting all the lamps and ringing the bells. By this device, therefore, the guest is not only apprised of the danger, but is provided with sufficient light by which to escape. The cost of installation

is small and the working expenses trifling, while the arrangement is so simple that nothing can ever get out of order.

PAWTUCKET, R. I. PLANT INCREASED. Messrs D. Goff & Sons, who have been using the Edison light in their braid mill at Pawtucket, R. I., have increased their plant from a Z dynamo and lamps to an H dynamo with 350 A lamps.

SANITARY EFFECTS OF THE EDISON LIGHT IN THEATRES. A series of careful tests, with a view of comparing the difference between gas and electric illumination, has recently been made in the Royal Residence Theatre of Munich, which is lighted by Edison lamps. These tests were made by Dr. Max Von Pettenkofer, Royal Privy Counsellor and Professor of the Hygenic Institute of the Royal Ludwig-Maximilian University, Munich. Dr. Von Pettenkofer's report, after describing the numerous tests made with gas and the Edison light, both in the empty theatre and during performances, concludes as follows:

"From the aforesaid tests, the following two conclusions have been reached to a certainty:

FIRST. That electric illumination prevents, to an eminent degree, an excess of heat in the atmosphere of a theatre.

SECOND. That electric illumination, although unable to render ventilation unnecessary, requires less ventilation than gas illumination, for the reason that in gas illumination, ventilation has to be directed not only against the vitiation of the atmosphere by the people, but also against the heat and the products of combustion of the gas light; while in electric illumination ventilation has only to influence respiration, perspiration, and their consequences."

PHILADELPHIA. PUMPING STATION TO BE LIGHTED. An order has been given to us to install a plant of one Z dynamo and 60 A lamps in the Belmont Pumping Station of the Philadelphia Water Works.

AUGUSTA, GA. ANOTHER COTTON MILL PLANT. The National Manufacturing Company has ordered for its Cotton Mill at Augusta, Ga., a plant of one L dynamo and 125 A lamps.

This plant will replace arc lamps, which have been taken out

GERMANY. AN EDISON COMPANY. Under the title of "*The German Edison Company For Applied Electricity,*" a Company has recently been organized to exploit the Edison system of lighting throughout the whole of Germany. The parties to the contracts under which this company was formed were, besides Mr. Edison and the Edison Electric Light Company of Europe, Limited, the Compagnie Continentale Edison, the National Bank of Deutschland, the banking house of Messrs. Sulzbach Brothers, the banking house of Jacob Landau, and the German co-partnership of Messrs. Siemens & Halske. This latter firm will take a very prominent part in the manufacture and installation of Edison plants in Germany, under this combination of interests.

The capital of the German Company is 5,000,000 Marks, divided into 10,000 shares of 500 Marks each, and the period for which the company is formed is 50 years.

TESTIMONIAL FROM KOLB'S RESTAURANT, NEW YORK. The following letter is from Mr. Richard Kolb, one of our customers in the First District, supplied with light from the Pearl Street Station. The letter was written to a gentleman seeking for information about our light, and we publish it with his consent:

"KOLB'S RESTAURANT, 164 Pearl Street, May 3d, 1883.

COL. G. W. SHERMAN.

DEAR SIR:—I take great pleasure in answering your inquiry in regard to Edison's Incandescent Electric Light, which I have been using for the last nine months. It has been giving me entire satisfaction, and is the most perfect light that I have ever used, its cost is no more than gas, in fact it has no equal

with any light so far in use. It is bright, steady, clean and easily managed, and always there when wanted, day or night, and entirely free from danger of fire.

In my estimation I consider this the most perfect mode for illuminating, and should it be even more expensive than gas, I should not like to be without it.

Yours,
RICHARD KOLB."

HYGIENIC SUPERIORITY OF INCANDESCENT LIGHTS. The following tribute to the hygienic superiority of the incandescent lamp in dwellings is taken from an article by B. H. Thwaite, C. E., F. C. S. L. entitled "A Hygienic comparison between the Light of Electricity, and that of Coal Gas," printed in the *American Gas Light Journal*, May 16th, 1883:

"The heat developed by the resistance of the minute filament of carbon, as arranged in the *incandescent* lamp of Edison, would not, of course, produce any rearrangement of the gases constituting the atmosphere; and even if it did, as the filament of carbon is fixed *in vacuo*, there could be no possible vitiation of the atmosphere. Hence *per se* the electric light of the incandescent type is hygienically satisfactory. * * * Besides the nitrogen oxides produced by the *arc* light, probably as much carbon dioxide is produced, in amount, for the same illuminating power as is produced by the combustion of coal gas. In both descriptions of artificial light the luminosity proceeds from the same cause, namely, carbon in an atomic or solid state heated to incandescence. The electric light produced by *incandescent* lamps is in almost perfect accordance with the laws of visual or ocular hygiene; allowing, as it does, various colors to be distinctly chosen as in solar light. The *arc* light, however, is not so satisfactory. The varying light-densities, caused by the use of heterogenous carbons, produce ocular muscular fatigue, besides rendering the retinal image very indistinct. It is generally conceded that the nearer a system of artificial illumination approaches in resemblance to that of the mean intensity of diffused sun light, the more perfectly is the system adapted to the human organs of vision. The degree of the density of an illuminant can be judged with approximate accuracy by the degree of darkness of its shadow; and, judging from this standard, the naked *arc* light is too intense, at least for domestic and workshop purposes, as the shadows it produces are considerably darker than those of the light from the unclouded noonday sun. But, of course, the density of the light can be reduced to any degree by the use of globes of glass of more or less opacity. This, however, is an expensive remedy, as a great percentage of the electrical energy is wastefully absorbed."

ALBANY. A NEWSPAPER LIGHTED. We are installing a plant of one Z dynamo and 60 A lamps in the newspaper and printing offices of the Press Company, publishers of the *Daily Press and Knickerbocker*.

BUFFALO, N. Y. GRAIN ELEVATOR LIGHTED. A plant of one L dynamo and 150 A lamps has been installed in the grain elevator of the New York, Lake Erie & Western Railway Company at Buffalo. The dynamo is driven by an 8½ x 10 Lawrence engine. The disposition of the lamps is as follows:

Elevator	99
Receiving tower	25
Office	7
Yard	27

The lamps in the yard are placed in clusters of 9 each.

An entirely new feature has been put in use in this elevator. The storage bins which are 60 feet in depth, have been fitted up with a portable Edison light arranged on an electric reel for lowering it to the bottom of the bin, thus enabling the workmen to ascertain if the bins are emptied.

ANOTHER STEAMSHIP TO BE LIGHTED. An order has been received by the London Edison Company for a plant of one L dynamo and 150 A lamps to light the new steamer "Adelaide," belonging to the Australian Steamship Company.

WATERVILLE, ME. COTTON MILL PLANT INCREASED. The Lockwood Company have been using a K dynamo and 250 A lights in their weave shop during the past winter. They manufacture white shirtings and fancy cotton goods. Although they have gas works on their own premises, the use of our light during the

winter has proved so satisfactory on account of its purity and increased light, as well as its economy, that we have received an order from them to replace the K with an H dynamo, making a total of 350 lights, to light the remainder of their weave shop.

WASTEFULNESS OF GAS. Prof. S. P. Langley, Allegheny Observatory, read a paper before the National Academy of Sciences, Washington, April 20th, showing the wastefulness of gas. Taking the total amount of energy in a gas burner as 1000, Prof. Langley states that only 24 parts of this perform any service as light, and that 976 parts are wasted; also that about 99 per cent. of the production of a gas plant is wasted as compared with an ideal light in the production of which there should be no waste of energy. His paper has not been printed, but the following synopsis appeared in the New York *Tribune*, April 21st:

"Prof. Langley's paper was 'On the Spectrum of an Argand Gas-burner,' and was illustrated by frequent reference to a large chart upon which curves produced by the rays of the sun and of an argand burner respectively, as shown in the spectrum. Professor Langley's experiments were designed to ascertain the amount of energy which is in the form of light only by an argand burner; and for purposes of comparison he had subjected sunlight of equal intensity to like experiments. He showed by the curves on the chart that, of the energy expended to fill an area of, say, 1,000 parts, 976 parts lie outside of and beyond the visible spectrum, while only 24 parts fall within its limits; in other words, 976 parts of energy are wasted while only 24 parts performed service as light. Reduced to percentages, the waste energy is represented by 97 6-10, and the heat employed as light by 2 4-10. The same amount of energy expended by the sun furnishes 34 per cent of light, and 66 per cent is waste. Taking everything into consideration, Professor Langley estimated that, putting the value of the gas-plant of the country used in producing light at $30,000,000, about 99 per cent. of it is wasted, as compared with an ideal light in the production of which there should be no waste of energy. An argand gas-burner uses in the form of light less than 1 per cent of the energy required for its production. The same process which would increase the quantity of light from a given degree of energy would also improve its quality." * * *

FALL RIVER, MASS. COTTON MILL TO BE LIGHTED. We have received an order for a plant of two H dynamos, and 650 A lamps to be installed in the Flint Mills, Fall River. We have received this order by reason of the satisfactory working of our light at the Conanicut, King Philip, and Davol Mills, where the light was seen in operation before the above plant for the Flint Mills was ordered.

FALL RIVER, MASS. COTTON MILL PLANT. A plant of one H dynamo and 350 A lamps has been installed in the Davol Mills, Fall River. This mill manufactures fine white shirtings and fancy cotton goods. They formerly used carburetted gas, which caused a sooty deposit not only on the walls and ceilings, but also on the cloth, entailing much loss thereby. Moreover, as the ceilings were low, it was necessary to burn gas in the weave shop during a greater part of the day, and the smoke and heat of the gas occasioned great discomfort to the weavers. All these objectionable features have now been removed by the use of the Edison light.

LOUISVILLE EXPOSITION LIGHTED BY EDISON LAMPS. We are now lighting the Southern Exposition, at Louisville, with 4,600 A lamps. This installation is so well described in the *Louisville Courier-Journal* of July 4th, that we reprint the following extracts therefrom:

"The Machinery Committee of the Southern Exposition met yesterday afternoon (July 3d) at the building and signed the contract with the Edison Company for Isolated Lighting, of New York. The contract is the largest that was ever made for lighting a building with electric lights.

The company agrees to light the building and gate houses with 4,600 Edison lights of 16-candle power each, in other words, the plant that will be used will furnish more light than any other plant ever did. It will even be larger than the combined plant used at the great electric light exhibition at London last year.

Some idea of the undertaking may be gained when it is announced that the wire to be used would reach 40 miles in length if stretched out in a straight

line. The wire is all of copper, and much of it is very thick. Its weight will be 40,000 pounds. The number of dynamo-machines will be fifteen, worth about $4,000 each. To run them will require four of the Armington & Sims engines used by the Edison Company.

The cost of the entire plant will be about $100,000, and it will require about 100 men working constantly from now until the end of the month to string the wires and put all the electrical machinery in order. The plant will be sufficient to supply a village with 20,000 lamps, as not more than a fifth of the lamps in a town are ever lighted at the same time. Here all will be burning at once. The plant will be equivalent to a gas plant manufacturing 35,000 cubic feet per hour. These figures give some idea of the enormous supply of light that will be required and furnished; but no one can really comprehend how much light will be necessary until the great building is entered and inspected; then it may be understood what the necessities are.

While the 4,600 lamps are thought on a careful estimate by experts sent out by the lighting company to be more than sufficient to light the building brilliantly, there is no doubt that many exhibitors will want to make a specially brilliant display over their exhibits, and the electric light can easily be furnished from the mains already laid. Edison himself will be there to superintend the completion of the work preliminary to August 1. The advantage of the incandescent electric lights in such a building as the exposition building cannot be overestimated. It generates no heat, nor does it absorb any of the oxygen of the air. Were the building lighted by gas the consumption of oxygen would probably equal the amount that a crowd of 75,000 people would use up. The display of electric lights will certainly be beautiful, and those who see it will have the satisfaction of knowing that they have seen the largest display ever made. The Electric Light Company will make special exhibits of electric motors and of submarine lamps, which are very wonderful and interesting."

The following extract is from the Louisville *Courier-Journal*, July 25th, and relates to an experimental trial of part of the plant installed in the Louisville Exposition building:

"The engine that was set going yesterday was an Armington & Sims, one of the engines used in the electric lighting. The work of the Edison Company has been most satisfactory, and much credit is due to them that their engine was yesterday ready for use, and that the electric plant was in such a condition that the current could be turned into the wires. Their engine worked as smoothly and noiselessly as an engine could work, and their lights were beautiful to the eye. Several lamps were lit and burned in the presence of an admiring crowd; if it had been necessary the night circuit of 200 lamps could have been set going; but as the exhibitors who are at work in the building do not yet want to work at night, when they do, Mr. Moore, the Edison Company's

General Manager, says that the light will be ready, as it is, indeed, even now. Mr. Moore and his assistants deserve great credit for their promptness in having the largest plant for electric lighting ever laid ready even before the time it was required. It was a stupendous undertaking to place forty miles of wire, several engines, fifteen dynamo-machines, hang the lamps and make the other necessary preparations. The beauty of the Edison system was illustrated yesterday in the small automatic electrical regulator, which, like the governor of an engine, regulates the current of electricity that goes into the wires. By means of this regulator, if all but one of the lights of a two-hundred-lamp circuit were suddenly turned off, the one remaining lamp would burn as steadily and as brightly as it had done before, and without diminishing or increasing its intensity."

In the next Bulletin we hope to give a full report of the working and effect of this large plant during the progress of the Exposition.

LONDON, ENGLAND. THEATRE TO BE LIGHTED. The London Edison Company is installing a plant of four L dynamos and 600 A lamps in the Criterion Theatre, Piccadilly, London. The wiring will be arranged on eight circuits, each under independent control by means of a special regulator, capable of lowering or raising the lights to any desired intensity.

MILAN. PROGRESS OF CENTRAL STATION. The Italian Edison Company has purchased the Santa Radegonda theatre for its central station, and has been for some time installing the plant. This installation will ultimately comprise 12 of the Edison 1,200-light dynamos, of which 4 have already been installed, and with which the station has been started. The motive-power is supplied by Porter-Allen and Armington & Sims engines, furnished with steam by Babcock & Wilcox boilers. The dynamos and engines have been placed below the foundation of the building so as to avoid any vibration of the station. The arrangements in the interior of the station are similar to those in our Pearl street station in New York, described in previous bulletins.

We take the following extract from the *Electrician*, London, July 28th, relating to the starting of this station:

"On the 28th of June the *Comitato per le Applicazioni Dell' Elettricità Sistema Edison in Italia* inaugurated the central station for electric lighting in Milan with a *soirée* in the Teatro Manzoni. The central station of Milan, erected near the cathedral, has now four Edison 1,200-lamp dynamos, and has room for eight more dynamos of the same size. The construction began in November, 1882, and the plant was ready to start in June, 1883. The company made contracts for supplying light to 3,500 lamps, especially for cafés, restaurants, clubs, and some stores in the most frequented part of the city. In the district which is supplied with Mr. Edison's underground system, there are two theatres, one of which is the celebrated Theatre Della Scala, which will be completely lighted for the end of this year with about 2,000 lamps." * * *

PRAGUE. THEATRE TO BE LIGHTED. The National Theatre, now being constructed at Prague, the capital of Bohemia, will be lighted by the Edison system. The plant will consist of one Z and seven K dynamos and about 2,000 A lamps.

MUNICH. BREWERY LIGHTED. An installation of 40 A and 40 B lamps with a Z dynamo has been in operation for six months in the brewery De la Croix d'or, Munich. The plant is in use every day from 6 o'clock in the evening till 2 o'clock in the morning.

CÖSWIG, GERMANY. PAPER FACTORY LIGHTED. A plant of one Z dynamo and 60 A lamps has been installed in a paper factory at Cöswig, Germany.

TRIESTE. AUSTRIA. MAN-OF-WAR LIGHTED. An installation of one L dynamo and 150 A lamps has been made on a man-of-war belonging to the Austrian Government.

THE EDISON LIGHT AT THE CZAR'S CORONATION. We mentioned in the last Bulletin that on the occasion of the Czar's coronation at Moscow, the Kremlin was illuminated with 3,500 Edison lamps. We now give the following extracts from the St. Petersburg *Herald*, referring to this lighting:

"The illumination that took place on the day of the coronation drew the entire population of Moscow into the streets, particularly in the vicinity of the Kremlin. Everybody wanted to see the illumination which was so much read and talked about for weeks and which should surpass anything hitherto seen; and really this illumination presented a grand and incomparable aspect. The three towers of Iwan Weliskij shed a fairy lustre. The intensity of the light and its absolute steadiness, which cannot be obtained by any other system of lighting, all contributed to remind us of those fairy palaces of our childhood of which we still retain a vague remembrance."

The journal *Nowe Wreme* says:

"Iwan the Great, fully illuminated with Edison lamps, presented a truly magic aspect."

SPAIN. ARSENAL LIGHTED. The Spanish Government has given an order for an Edison plant consisting of two L dynamos, with 171 A and 250 B lamps, to light the Arsenal de la Carraca, Spain.

BERLIN. A THEATRE TO BE LIGHTED. The new Deutches Theater, Berlin, is to be lighted by Edison lamps. The contract between the directors of the theatre and the German Edison Company has been signed.

BERLIN. RESTAURANT LIGHTED. The rooms of the restaurant at the Exposition Hygiénique, Berlin, are lighted by 250 A lamps.

NEUWIED, GERMANY. TOBACCO FACTORY PLANT. The tobacco factory of Mr. J. P. Schneider, at Neuwied, has been lighted by a plant of 28 B lamps almost a year, and the light has given such satisfaction that the plant is to be increased.

CAEN, FRANCE. EXPOSITION LIGHTED. The exposition at Caen, which was opened on the 5th of June, is entirely lighted by the Edison light. There are upwards of 300 lamps placed in the various galleries and through the walks

COGNAC, FRANCE. CAFÉ LIGHTED. A plant of one E dynamo 17 A lamps, has been installed in the Café du Châlet, at Cognac. This plant has been in operation since May 20th.

COGNAC, FRANCE. DISTILLERY PLANT. An installation of one Z dynamo and 60 A lamps has been placed in the distillery of Mr. Gravelles, Cognac, France.

ANNONAY, FRANCE. FACTORY AND RESIDENCE LIGHTED. A plant of one Z dynamo and 60 A lamps has been installed at Annonay, for Mr. Jomaron, to light his leather factory and residence.

EAUX-BONNES, FRANCE. HOTEL PLANT. A small plant of 17 A lamps with an E dynamo has been installed in the Hotel-de-France, Eaux-Bonnes. Mr. Taverne, the proprietor of the hotel, desired a 60-light plant, but had not sufficient power at his disposal to drive that size of dynamo. The light gives great satisfaction, particularly in the dining room, where the absence of heat is particularly gratifying.

VOIRON, FRANCE. PAPER FACTORY LIGHTED. An installation of one E dynamo, 28 B and 3 A lamps, has been in operation in the paper factory of Messrs. de Guérimand & Co., at Voiron, since April and has given great satisfaction.

ROUBAIX, FRANCE. WOOLEN MILL PLANT. There has been installed in the mill of Messrs. Amédée Prouvost & Co., manufacturers of woolen goods, a plant of one L dynamo and 150 A lamps.

PARIS. BONDED WAREHOUSE LIGHTED. An installation of one K dynamo, with 300 A and B lamps, has been made in the bonded warehouse on the quay Saint-Bernard, Paris. Not only is light furnished, but electric power from the plant is used throughout the various departments.

CREFELD, GERMANY. PAINT FACTORY PLANT. A small plant of 47 A and B lamps has been installed in the paint factory of Mr. H. O. Neuhaus at Crefeld. The light enables the workmen to mix colors as well at night as by daylight.

ESSONNES, FRANCE. PAPER MILL PLANT INCREASED. Messrs. Darblay & Béranger, who had an installation of one Z dynamo, 60 A lamps, placed in their paper factory last February, have ordered a second installation of another Z dynamo and 60 A lamps.

RIVES, FRANCE. PAPER FACTORY LIGHTED. Messrs. Blanchet & Kléber, manufacturers of photographic paper, have an Edison plant of one Z dynamo, 29 A and 36 B lamps, installed in their factory at Rives.

IVRY-SUR-SEINE, FRANCE. SMALL PLANT. A plant of one E dynamo and 17 A lamps has been installed in the foundry of M. Lemoine, Ivry-Sur-Seine, for lighting his offices.

BORDEAUX. OIL MANUFACTORY LIGHTED. A plant of one L dynamo has been installed in the oil manufactory of Messrs. Maurel & Prom and Maurel Brothers. At present only 88 A lamps are placed in position, but the whole number, 150, will be used when some additions to the factory are completed.

LONDON, ENGLAND. LARGE RESTAURANT WIRED. The premises of Messrs. Gatti, restaurant, Strand, London, are being wired by the Edison Company there for 300 lamps. These lamps will be supplied with current from a central station which it is proposed to establish to light that district.

NEW ZEALAND. GOVERNMENT OFFICES LIGHTED. The Government Printing Offices at Wellington, New Zealand, are now lighted by an Edison plant of one Z dynamo and 40 A lamps.

MELBOURNE, AUSTRALIA. The Victoria House of Assembly at Melbourne, is lighted with an Edison plant, consisting of one Z dynamo and 40 A lamps.

BRISBANE, QUEENSLAND. GOVERNMENT BUILDINGS LIGHTED. A plant of two dynamos and 350 A lamps has been installed in the Queensland Parliamentary Buildings, and the Queensland Government Printing Offices, at Brisbane, Queensland.

PUBLISHED TESTS OF EDISON LAMPS AND DYNAMOS. The following letter may be of interest as containing a record of the principal published tests of the Edison dynamo and lamps:

"NEW YORK, August 13th, 1883.

E. H. TALBOT, ESQ., Sec'y.

NATIONAL EXPOSITION OF RAILWAY APPLIANCES,

Chicago, Ill.

DEAR SIR:—As to whether the Edison Company had better go to the expense and trouble of having a test made of its apparatus exhibited at the Railway Exposition, we beg to say that several well-known tests heretofore made and published show sufficiently, we think, the scientific efficiency of the Edison dynamo and lamp, while their commercial value is shown not only by the fact that nine-tenths of the incandescent lamps now burning anywhere in the world are the Edison, but by the further fact that as regards the principal feature of the Edison system, supplying light from a central station by means of underground conductors and meters, Mr. Edison enjoys an absolute monopoly, without competition. The tests referred to will be found in the following published reports:

(1). Report upon the comparative efficiency of the Edison dynamo, by Professors C. P. Brackett and C. A. Young, of the College of New Jersey, Princeton, published in the *Scientific American*, May 15th, 1880.

(2). Report of Mr. John W. Howell, of the Stevens Institute of Technology, Hoboken, on his tests of the Edison dynamo, lamps and conductors, published in *Van Nostrand's Engineering Magazine*, January, 1882.

(3). Report of the Sub-Commission on incandescent lamps, made to the President of the Experiment-Commission of the Jury of the International Exhibition of Electricity, Paris, printed in the London *Electrician*, June 17th, 1882.

(4). A paper presented to the French Academy, Paris, dated November 20th, 1882, by five members of the Experiment-Commission of the Jury of the International Exhibition of Electricity, giving the results of their tests on incandescent lamps, said tests being supplemental to the Commission's work on machines and arc lamps. This paper is printed in the *Comptes Rendus* of the above date.

These reports show that as regards the Edison dynamo there is but a slight difference between its working efficiency and theoretical perfection, and that as regards the Edison lamps, those manufactured by our Company are superior to the same as made by any other company.

Although Mr. Edison has improved his dynamo, and more especially the lamp, since these reports were made, nevertheless, we are willing to abide by them as correctly stating the efficiency of our apparatus, both for commercial and competitive purposes.

Respectfully yours,

THE EDISON ELECTRIC LIGHT COMPANY,

By S. B. EATON, President."

U. S. STEAMER "ALBATROSS." OFFICIAL REPORTS ON THE EDISON LIGHT. We have obtained copies of the reports on the Edison Light, on the U. S. Fish Commission Steamer "Albatross," made by Lieut. Schroeder, and Engineer Baird, to the Commanding Officer, Lieut. E. L. Tanner, U. S. N. These reports bear evidence of having been made with great care and intelligence, and the following extracts therefrom will be read with interest.

The following are extracts from Lieut. Schroeder's report:

"There are 136 Edison incandescent lamps in place on board this vessel, of that number, under ordinary circumstances 40 to 45 are generally in operation the greater part of every evening, beginning at dark and ending at about 11 P. M.

During the quarter ending March 31st, 1883, eighteen lamps have been disabled, as follows:

- 10 Broken in handling.
- 4 Burned out.
- 1 Burned out by short circuiting of two branch wires.
- 1 Gradually unscrewed from socket, owing to vibration of hull, and fell on deck, breaking the glass and filament.
- 1 Carbon filament broken by caulking the deck above.
- 1 Carbon filament broken while experimenting.

The invoice price of each lamp being one dollar, the additional cost of illumination on account of breakage of lamps has been $18.00, over and above first cost of plant.

During the quarter the dynamo-machine has run 540 hours. Of the 136 lamps in position 34 have been in operation the whole time, or 540 hours each = 18,360 hours in all, of the remainder, the hours of incandescence have been as follows:

2 — 440	hours	each	= 880	hours.
4 — 410	"	"	= 1,640	"
22 — 340	"	"	= 7,480	"
8 — 100	"	"	= 800	"
20 — 50	"	"	= 1,000	"
18 — 10	"	"	= 180	"
			= 11,980	
34 — 540	"	"	= 18,360	
Total,		.	= 30,340	

The running expense in lamps has therefore been $\frac{\$18}{30,340} = 59$ one-thousandths of a cent per lamp in operation per hour. For illuminating the entire vessel the running expense in lamps has been $\frac{\$18}{540} = 3\frac{1}{3}$ cents per hour.

The life of the lamps that have burned out has been as follows:

No. 49	(8-candle power)	92	hours.
" 90	(8-candle ")	369	"
" 68	(16-candle ")	195	"
" 41	(8-candle ")	99	"

A mean of these would obviously be a very unfair showing of the average life of the Edison lamp. The imperfect ones give way first, and a correct average, of course, can only be had by waiting to consider the best as well as the poorest. It is only fair also to add that the breakage by accident has been greater than will probably continue to be the case, the crew being extremely raw, green and unthinking; in handling the lamps, frequently without authority, they have apparently used more force, as a rule, and less dexterity than the occassion required, simple as their manipulation is. Familiarity with the light will doubtless decrease this source of expense.

Furthermore, the lamp that was disabled by caulking overhead, was purposely left in place to test its safety under those conditions, it being attached to the deck that was being caulked; the burning of one by short-circuiting occured before the installation of the system was completed, and resulted from the loose ends of two branch wires coming in contact; the destruction of a third occured during, and was apparently caused by some experiments which proved an abnormal condition for an incandescent system of illumination.

As shown above, only four of the eighteen have burned out, which would reduce the legitimate running expense to $\frac{\$4}{30340} = 13$ one-thousandths of a cent per lamp in operation per hour, or $\frac{\$4}{540} = 74$ one hundredths of a cent per hour for lighting the vessel.

Some of the globes have begun to be discoloured by the wasting of the filaments (Grote's effect), but not sufficiently to affect sensibly the amount of light given out.

Apart from questions of economy, the light commends itself strongly for use on ship-board. Its chief advantages over the means of illumination in common use afloat, are:

1. The absence of heat, smoke, smell and dirt, and the non-consumption of oxygen;—important points at all times and especially in bad weather when hatches are closed.

2. The almost absolute immunity from danger of fire; even in cases of short-circuiting or arcing between two branch-wires, which are the only ones

liable to this mishap, the destruction of the safety-plug is simultaneous with the passage of the small spark, the circuit being thus instantly broken, and further danger avoided.

3. The great convenience of having it ready to turn on in any place, including the magazine passage, holds or store-rooms, where otherwise an oil lamp would have to be used with its peculiar characteristics of dimness, dirt and danger.

4. Its ability to remain in operation under water, when it may frequently be useful in examining or repairing a ship's bottom, or clearing a hawser from the propeller at night. It is likewise unaffected by rain or wind.

The steadiness of the light and its softness combine to make it most agreeable to the eye, and excellent for reading or working on a chart. The brilliance, of course, depends upon the velocity of the dynamo-machine, and the amount of resistance introduced into the circuit of the field magnets; but with average incandescence it is found that ordinary print can be read with comfort on a table by the light of one 16-candle, or two 8-candle lamps, four feet above it, fitted with porcelain shades. With one 8-candle lamp in that position, the print cannot be easily read without a tin reflector, which materially affects the dispersion of the light about the room. Four 8-candle lamps, with shades, situated four feet above a mess-table seating twelve persons, illuminate it brilliantly.

The berth-deck of the vessel is 42 feet long, 23 feet average breadth, and 8 feet high. It is lighted by six 8-candle lamps, three on each side. They illuminate it thoroughly, so that the numbers on the bags or hammocks can be read with perfect facility in any part or in any position.

The fore hold has, on the after bulk-head, one 8-candle lamp on each side, with tin reflectors. By the light of one of them, any piece of gear or object of any kind on the same side of the hold, can be immediately recognized throughout its length (25 feet), and could easily be picked out at a greater distance.

Throughout the entire vessel, the efficiency of the illumination is the same, and is a great source of convenience and comfort to all serving on board.

The great convenience of the portable hand and stand lamps need not be weighed upon, as that is the same on ship board as on shore. One, of 16-candle power, has been tried as a submarine light, its flexible cord and socket being wrapped with insulating tape. It has been under water, in all, sixty hours so far, with perfect impunity. At sea, with clear water, its light has been traced until it reached a depth of 100 feet; and after being in operation all one night at a depth of 150 feet (the length of the cord), it was found to be still air and water-tight when hauled up, and is apparently in as good condition now as those in ordinary use."

The following extracts are from Engineer Baird's report, above referred to:

"The economy of the Edison incandescent system of lighting is a question of commercial as well as engineering importance, and as this is the first U. S. ship to utilize this important invention, I have considered it necessary to make more than the usual test of the machinery, that we may obtain figures which will enable the Commissioner to judge intelligently as to its real and comparative value.

The *Plant* consists, first, of an engine of the Armington and Sims make, having a single cylinder of 8½ inches diameter of bore and a stroke of piston of 10 inches. The engine is horizontal, is mounted on a rigid cast iron bed-plate and has a centrifugal governor in the fly-wheel; the governor weights are connected to internal and external eccentrics and operate by shifting these eccentrics in equally angular and opposite directions, which diminishes the throw of the valve (without effecting the lead,) and thus effects a shorter cut-off. It is sensitive, and, so far as I can measure, regulates the speed of the engine to 300 revolutions a minute without regard to the initial pressure on the piston or the resistance on the dynamo.

Second, a Z dynamo, having its field magnets vertical, the armature revolving in the field between the magnets, in the induced current. A resistance box is placed in the circuit of the magnetic field which regulates the pressure, and, by altering the switch on the resistance box, the incandescence of the lamps is raised or lowered at pleasure. The object of this method is to equalize the internal and external resistance, that the maximum economic effect may be realized, hence the great economy of the Edison system. For example, the dynamo is designed for 120 B lamps of 8-candle power each, and if only 60 lamps be in circuit the resistance of the circuit will be doubled and the field resistance must be switched in to balance it.

Third, there are 139 eight candle-power B lamps of 69 ohms resistance each, placed in multiple arc, and so distributed through the vessel as to illuminate every place where light is required. There are four circuits (of copper wire) from the dynamo, viz: a double circuit – main—on each side of the ship, for the forward lamps; a double circuit, on each side of the ship, for the after lamps; a single independent circuit for the outside lamps with the switch in the engine room, and an independent circuit for the engine room. The mains are not only double circuits but each main consists of two No. 10 wires. The advantage of this system of wiring is manifest, in the event of breaking a wire, from collision or other cause, the remaining wires would be ample to carry the current. The mains, however, are brought together and soldered where they are attached to the binding posts of the dynamo. The wires are insulated with cotton cloth and white lead, and when passing through damp places they are further protected by rubber tubing. On each main wire, and near the dynamo (as well as near each group of lamps), is a

'cut-out plug' or 'safety catch,' which contains a short piece of fusible alloy; the office of this plug is two-fold; it may be used as a switch to cut that wire out of the circuit at pleasure, and also to prevent the heating of the wires beyond the fusing point of the alloy (400 degrees), thus rendering the system harmless as a fire agent. These 'cut-outs' are essential as the copper wires would, in event of a short circuit, melt and set fire to adjacent wood work.

The absolute safety of the Edison system, against injury to human life, commends it very highly. The low pressure of 51 volts is insufficient to pass through a man's body and can, therefore, never injure him.

Manner of Making the Experiments.

By means of a steam-engine indicator I measured the power required to run the engine and dynamo, the current being switched off. By the same instrument I measured the indicated power required to run 45, 50 and 70 lamps, respectively. * * * By deducting from these experiments, respectively, the power required to run the engine and dynamo, we obtain the power applied to the shaft, and from this quantity we deducted the friction of the load, leaving, as a remainder, the net powers required to revolve the armature, in the magnetic field, with 45, 50 and 70 lamps in circuit.

Distribution of the Power.

Power required to run the engine and dynamo	3.56
Indicated horse-power required to run 45 incandescent lamps	5.79
Indicated horse-power required to run 50 incandescent lamps	5.85
Indicated horse-power required to run 70 incandescent lamps	6.92
Net horse-power applied to the revolution of the armature in the magnetic field, using 45 incandescent lamps	1.80
Net horse-power applied to the revolution of the armature in the magnetic field, using 50 incandescent lamps	1.85
Net horse-power applied to the revolution of the armature in the magnetic field, using 70 incandescent lamps	2.84
Mean number of incandescent lamps per indicated H.P. using 45 lamps	7.77
Mean number of incandescent lamps per indicated H.P. using 50 lamps	8.50
Mean number of incandescent lamps per indicated H.P. using 70 lamps	10.11
Mean number of incandescent lamps per net H. P. using 45 lamps	25.
Mean number of incandescent lamps per net H. P. using 50 lamps	27.02
Mean number of incandescent lamps per net H. P. using 70 lamps	24.63

The wires being fixed, their resistance may be considered a constant quantity and the only variation as existing in the engine and dynamo; the distribution of the power, as above recorded may, if necessary, be verified by electrical measurements on the wires.

Relative Economy of the Lamps.

The cost of running the incandescent lamps, as compared with coal gas lighting is a matter of commercial as well as engineering interest, and it is my

purpose to confine the comparison to these objects alone. From the quantities determined and recorded above, these comparisons are made, candle-power for candle-power.

So far the greatest number of lamps in operation at one time has been 70; we ordinarily use from 45 to 50. The number of lamps per indicated horse-power increases with the number of lamps used, for the reason that the engine works more economically at higher powers.

The comparison between these incandescent lamps and light from coal gas, as measured by a photometer, is not a fair one, inasmuch as the gas burner itself (to say nothing of part of the fixture) is under the jet and casts a shadow underneath, while the Edison lamps are inverted and the shadow is above. As the light is used under the lamp a larger percentage of light from the inverted fixture will be cast upon the work beneath, and for this the photometer makes no reduction.

Although the B circuit is installed to give 8-candle power lamps they really emit about 10, which is also an unbalanced account in favor of the electric lamps.

The cost, in coal, of a horse-power developed by the dynamo engine has been arrived at by calculating the quantity of steam passed through the steam cylinder, and reducing this to pounds of water and dividing this by the pounds of water evaporated by a pound of coal. Had steam been used for lighting alone this calculation would have been unnecessary, but as steam was used, from the same boiler, to warm, ventilate and light the ship at the same time, the writer adopted this method of separating the respective powers. From these indicator diagrams I have calculated that a horse-power costs 30.7 pounds of water or 3.41 pounds of coal per hour. The cost of the coal was \$4.60 per ton, and the lubricating oil 65 cents per gallon. The consumption of oil is one quart in six hours, so that the cost, to us, to run the dynamo during the 70 lamp experiment was $(\frac{460}{2240} \times 3.41 \times 6.92) + \frac{65}{24} = 7.553$ cents per hour or $(\frac{7.553}{70}) = 0.1079$ cents per lamp per hour or $(\frac{0.1079}{8}) = 0.0135$ cents per candle-power per hour.

The coal gas company of Washington supplies gas of 17 candles power, used from a 4 foot bat-wing burner, at \$1.75 per thousand cubic feet. The cost of such a jet of gas then becomes $(\frac{175 \times 4}{1000 \times 17}) = 0.041176$ cents per candle-power per hour, or a little over three times what the Edison incandescent light is costing us on board this ship.

I have purposely omitted the cost of labor and the interest on the money invested in the plant as we have no additional men for running the dynamo nor engine, the officer on watch attending to it in addition to his other duties. The interest on the plant at six per cent. is only (\$3500 x 0.06=) \$210. We use about 50 lamps about six hours a day, so that the interest on the money invested is about $\frac{3}{100}$ of a cent per candle-power per hour, or hardly worth considering."

DEATHS FROM GAS. On February 5th, Henry Shaw, while making a connection between the main pipe of the West Manayunk Gas Company, and Dowells' paper mill, Manayunk, Pa., was overcome by escaping gas, and died in less than ten minutes. * * * On February 8th, a gasoline machine, in the restaurant of A. J. Smith, on Market Square, Norfolk, Va., exploded, wrecking the place completely. R. Pinner was killed, and five others injured. * * * W. S. Lawrance was found dead in bed at the Putnam House, Fourth Avenue and 26th Street, New York City, March, 1st, having been suffocated by illuminating gas with which the room was filled. * * * Mrs. Hannah R. Johnson was found dead in bed March 15th, at 215 Graham Avenue, Brooklyn, N. Y., having been suffocated by escaping gas. * * * On March 17th, Luther Tucker was found suffocated to death by gas in the Kimball House, Dover, Mass. * * * William Mulcahy, of No. 1,435 Filbert Street, Philadelphia, was found suffocated by gas in his room at the Brooklyn Bridge Hotel, No. 48 Chatham Street, March 17th. * * * Mrs. Barty was found insensible in bed at her home in Halifax, England, March 22d, the room being filled with escaping gas. She died five days afterwards. * * * On April 4th, an explosion, caused by escaping gas, occurred in Bond Street, Boston. The immediate neighborhood was shaken as if by an earthquake, and a dull rumbling noise accompanied the shock, which was felt in some directions for more than half a mile. The streets in the vicinity were torn up by the explosion, and cobble stones hurled through windows on the third story of some of the houses on Bond Street. Two children were killed. * * * Lizzie Hoag, of No. 200 West 57th Street, New York, was found in bed April 6th unconscious, the room being filled with gas which was escaping from the burner. She was removed to the hospital, where she died the next day. * * * Emanuel Miller was found dead in his room, No. 313 West 23d Street, New York City, May 4th. The

room was filled with gas which was escaping from an open burner. * * * On May 4th, E. O. Koller was found dead in bed in his room at the Northern Central Hotel, Baltimore, having been suffocated by illuminating gas which was escaping from an open burner in the room. * * * Two intoxicated workman at Cape May, N. J., unscrewed a gas meter connection in an empty house, and when found were dead, while the gas was still pouring from the opened pipe into the room.

DANGER FROM GAS. A gas meter in the house of Thomas Quinn, 512 Queen Street, Philadelphia, exploded March 28th, causing a fire. * * * A fire occurred at 135 Bedford Avenue, Brooklyn, April 5, caused by a curtain coming in contact with a lighted gas jet. * * * On April 6th a fire was caused by a gas jet at 240 West 59th Street, New York. * * * A series of gas explosions, some of them very dangerous, occurred at Walsden, England, April 6th. A large steam road-roller had injured some of the Gas Company's mains, so that gas escaped. The gas afterwards ignited. It also got into houses, and for about four hours there was a continual occurrence of explosions. Occupiers of houses had to put out their fires and get out of the way. Considerable damage was done to property, and the gas had to be turned off at the works before all was deemed safe. * * * A leaky gas pipe was the cause of a fire on April 9th, at 640 East 13th Street, New York. * * * On April 13th a series of violent explosions occurred in the east basement of the Palace Hotel, San Francisco, which were followed by a volume of flame pouring into the street from the place in the sidewalk where light was admitted into the vault through plates of thick glass. The cause of these explosions was the breaking in two of an eight inch gas main while some plumbers were connecting a pipe with the 1,500 light gas meter which had just been placed in position. The escap-

ing gas had ignited and exploded with great force, shattering to atoms the thick glass plates over the vault. Part of the meter, which was of three-quarter inch iron, was also blown to fragments. The volume of flame from the ignited gas was very great, and but for the prompt action of the firemen, would probably have done great damage to the hotel. Twenty-four persons were injured, most of them badly, and three or four dangerously. * * * Fire occurred at 199 Grand Street, Brooklyn, on April 15th, from some clothing taking fire from a gas jet. * * * The Chicago *Tribune* of April 19th, states that Mr. Downing Vaux has been seriously ill in consequence of gas-poisoning. The gas in his room was left burning low at night and a puff of wind extinguished it. For some time the injury to his health was thought to be permanent. * * *

No. 20.
OCT. 31, 1883.

TWENTIETH BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE, NEW YORK.

October 31st, 1883.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

CONTENTS.

FIRST DISTRICT, NEW YORK CITY. This plant is now in its fourteenth month of continuous running. We are at present lighting 508 houses, wired for 12,732 lamps, of which 10,164 are actually attached to the conductors, available at will. From the first, the number of consumers has steadily increased, month by month, as appears by the following statement showing the number of customers and lamps at the beginning of each month, since the station was first started:

DATE.	NUMBER OF CONSUMERS.		LAMPS IN USE.	LAMPS WIRED FOR.
October 1st, 1882	59	Customers	1,284	1,626
November 1st, 1882	94	"	1,704	2,468
December 1st, 1882	203	"	3,144	4,838
January 1st, 1883	231	"	3,477	5,328
February 1st, 1883	302	"	4,131	6,161
March 1st, 1883	324	"	4,331	6,596
April 1st, 1883	361	"	4,884	7,871
May 1st, 1883	386	"	5,574	8,581
June 1st, 1883	410	"	6,466	10,268
July 1st, 1883	436*	"	7,429	10,350
August 1st, 1883	443*	"	7,946	10,920
September 1st, 1883	455	"	8,218	11,192
October 1st, 1883	472	"	8,573	11,555
October 27th, 1883	508	"	10,164	12,732

*The reason for the difference between these figures and those in the 19th Bulletin is that complete reports had not been made at the time of going to press.

It may interest our stockholders to know who are the principal customers using our light in the First District, supplied by means of the underground conductors from the Pearl Street Station. The following list embraces some of the best known names:

NAME.	ADDRESS.	No. of Lamps.
Third National Bank	27 Pine Street	50
National Bank of Commerce	27 Nassau Street	72
Nassau Bank	Nassau and Beekman Streets	27
Drexel, Morgan & Co	23 Wall Street	103
Kidder, Peabody & Co	1 Nassau Street	40
Fisk & Hatch	5 " "	54
Merchants' Bank, of Canada	61 Wall Street	6
New York Safe Deposit Co.	140 Broadway	80
Chatham National Bank	196 Broadway	43
Continental Bank	5 Nassau Street	43
Laidlaw & Co.	14 Wall Street	16
Brown Brothers & Co	59 " "	59
Leather Manufacturers' Bank	29 " "	31
Bank of Montreal	59 " "	15
No. Br. Mercantile Insurance Co.	50 William Street	57
Citizen's " "	156 Broadway	13
National " "	60 Wall Street	5
New York Fire " "	72 " "	7
Guardian " "	54 William Street	31
Standard " "	52 Wall Street	14
London Fire " "	50 William Street	13
London & Prov. " "	31 Pine Street	11
Sun Mutual " "	3 Nassau Street	26
Norwich Union " "	67 Wall Street	23
Boston Marine " "	41 " "	23
Manhattan Life " "	156 Broadway	20
Niagara " "	135 "	30
Continental " "	102 "	129
Knickerbocker " "	64 Wall Street	6
Great Western " "	50 " "	14
Commercial Union " "	37 " "	26
Lancashire " "	40 Pine Street	23
Exchange " "	40 " "	15
Home " "	119 Broadway	146
Royal " "	50 Wall Street	46
Trans-Atlantic " "	62 Liberty Street	10

NAME.	ADDRESS.	No. of Lamps.
N. Y. Mining Stock & Petroleum Ex	60 Broadway	44
New York Stock Exchange	Broad Street	247
U. S. Assay Office	32 Wall Street	34
Mills Building	Broad Street	132
Times	Park Row	298
Commercial Advertiser	89 Nassau Street	124
Mail and Express	32 Park Row	49
Sun	Printing House Square	93
Truth	8 Spruce Street	13
Ansonia Brass & Copper Co	19 Cliff Street	68
E. Barr & Co. Ld	78 John Street	33
Geo. W. Ballou & Co	14 Wall Street	13
Barstow Stove Works	230 Water Street	68
C. A. Cheever	21 Park Row	400
Dennison Manufacturing Co.	198 Broadway	80
Berlin & Jones Envelope Co	134 William Street	225
Duncan Building	Pine and Nassau Streets	400
Henry Clews & Co	18 New Street	18
F. W. Devoe & Co	101 Fulton Street	46
Spencer Trask & Co	70 Broadway	23
Maurice Daly	258 Pearl Street	24
Engine Co. No. 32	108 John Street	24
Third Ave., E. R. R. Station	Fulton Street	24
Felter & Merrigold	260 Pearl Street	84
S. W. Green & Son	74 Beekman Street	49
Goodyear Rubber Co.	57 Maiden Lane	15
D. H. Houghtaling	142 Front Street	41
Judson Printing Co.	16 Beekman Street	43
Higgins & Cox	50 Wall Street	37
Howard Insurance Co.	66 " "	17
Iselin & Warner	50½ William Street	39
Keuffel & Esser	127 Fulton Street	20
Mark Mayer	100 " "	67
National Tube Works	104 John Street	28
New Haven Steamboat Co.	Pier 25, E. R.	43
American Bank Note Co.	140 Broadway	88
A. M. Sweet & Son.	6 Fulton Street	357
Silleck & Co.	98 " "	73
Shannon, Miller & Crane	46 Maiden Lane	29
Danl. Slote & Co.	119 William Street	28
W. H. Scheifflin & Co.	170 " "	156

NAME.	ADDRESS.	No. of Lamps.
Union Stove Works	70 Beekman Street	76
Vermilye & Co.	16 Nassau Street	23
Washburn & Moen M'f'g Co.	16 Cliff Street	29
Waterbury Watch Co.	52 Maiden Lane	12
Winslow, Lanier & Co.	26 Nassau Street	29
D. Wallerstein	174 William Street	21
Ira Perego	Nassau & Fulton Street	56
Richard Kolb	164 Pearl Street	40
London & Lancashire Ins. Co	46 Pine Street	43
Nassau Bank Vaults	Nassau & Beekman	43
Richardson, Boynton & Co.	232 Water Street	38
M. V. Cable	141 Fulton Street	46
German American Insurance Co.	119 Broadway	55
N. Y. Belting & Packing Co.	15 Park Row	49
Empire Insurance Co.	166 Broadway	6
C. M. Peck & Co	60 Liberty Street	18
S. Hoffman	202 Broadway	37
Drexel Building	23 Wall Street	21
Northwestern Fire Insurance Co.	Park Row	5

The subject of increasing the capacity of the Pearl Street Station is already under discussion, the demand for the light being in excess of our present facilities for supplying it.

BOSTON. FOREIGN EXHIBITION LIGHTED. We are now lighting, under contract, the Foreign Exhibition at Boston. The plant consists of three H dynamos, each of 400 lights capacity, driven by an Armington & Sims engine. The building is wired for about 1,050 lamps, of which 1,030 are of sixteen candles, 20 of eight candles, and 10 of fifty candles each.

We take the following extracts from the *Manufacturers' Gazette*, Boston, September 15th, regarding this plant:

"The disposition of the lamps in the Foreign Exhibition building is as follows:

In the Restaurant Vendome three 50-candle and forty-six 16-candle lamps, sixty-six in Washington Hall, 228 of the same in the main hall, 184 in the main art gallery, forty-five in the water-color gallery and eighty-one in the

antique room, China court twenty-eight, eighteen in the Irish kitchen, eighty-four in the main corridor, offices, ladies' parlor, etc., with the balance scattered around in the small rooms * * *. An automatic regulator equipped with two Edison lamps regulates perfectly the volume of the lights on the circuits, irrespective not only of the speed of the engine, but also of the number of lamps in circuit. * * *. Save in the art galleries, where the lights extend along semi-circular tin reflectors, the lamps are set in many rich and tasteful brackets and electrolier designs, made by Bergmann & Co., New York, manufacturers to the Edison Company of lamp fixtures and appliances. In the rotunda of the business entrance is an umbrella effect, as it is called, which consists of a 50-candle lamp suspended from a porcelain lined umbrella, with eight 16-candle power lamps ranged around and slightly above it, while the main corridor is fairly ablaze with soft, steady, mellow, yet brilliant light. The elegantly appointed and conveniently arranged press room is also fitted with the Edison light which is thoroughly appreciated by the scribes. Restaurant Vendome presents a very pleasing appearance, with its numerous Japanese umbrellas and Chinese lanterns, interspersed as they are with the electric light, among which are three umbrella effects. On the grand staircase to the main hall are two Newell-post fixtures with four Edison lamps. A unique feature of the Edison Company's display is the arrangement of its office quarters in Franklin Hall in front of Restaurant Vendome * * *. Suspended over the desk in the office is an immense Japanese umbrella, projecting from whose rib-tips are twenty 8 or 8-candle power lamps, which are equivalent to ten 16-candle lights. Depending from the umbrella-handle, and four or five feet above the desk, is a Bergmann artificial flower electrolier, with nine 16-candle lamps wreathed in among the flowers in vari-colored bell-shaped shades. The flower globe is of white glazed porcelain, rising from which is a shaft of gold-colored gas piping an inch in diameter, which was substituted for the umbrella handle below the braces, and the whole setting is decidedly artistic. Inserted in the floor, just inside the knee-hole of the desk, are two switches worked by the feet, the right-hand switch turning on or off the current to the rib-tip lamps, and the left hand one performing the same office for the electrolier lights, the extinguishing being done by the pressing out of a spring, and the lighting by pushing in a metallic button. The effect is magical, and a source of great wonder to the uninitiated. Several feet to the right of the desk, but in the same circuit with the umbrella lights, and affixed to one of the uprights of the building, is an ingenious electric cigar lighter, devised by Mr. Edison. The connection is made by grasping the handle of the lighter, the bars of platinum wire therein glowing with a bright red heat sufficient to ignite cigars and cigarettes; the current is broken by releasing the lighter. The setting and workings of the light at the Edison office form one of the most attractive sights of the exposition, as is evidenced by the number of interested visitors who find themselves in this quarter, and one might fairly consider himself an occupant of Aladdin's palace, so wonderful are the workings of the system."

PHILADELPHIA. LARGE DRY GOODS STORE PLANT. We have received an order from Messrs. Darlington, Runk & Co., Philadelphia, for a plant of two dynamos, 400 A lamps, to light their dry goods store. These lamps will replace Brush arc lights, which were found unsatisfactory.

FIRST PRIZES FOR THE EDISON EXHIBIT AT CINCINNATI. The Jury appointed by the Commissioners of the Cincinnati Exposition to report upon the subject of Electric Lights, consisted of Prof. T. C. Mendenhall, Chairman, Professor of Physics of the Ohio State University, Columbus, Ohio; Prof. H. T. Eddy, Professor of Mathematics and Engineering, Cincinnati University; Prof. Thomas French, Professor of Physics, Cincinnati University; and Mr. Robert Laidlaw, a mechanical expert connected with the establishment of Messrs. Lane, Bodley & Co., Cincinnati. The prize of five hundred dollars, for the best System of Incandescent Electric Lighting; also a gold medal, for the best Incandescent Electric Light; also the first prize for an Incandescent Lamp Dynamo, were awarded to the Edison Company, being all the prizes they competed for.

The first prize for the best System of Arc Lighting, and the first prize for the best Arc Light Lamp were awarded to the Thomson-Houston Company. The United States Electric Lighting Company, with the Weston arc light and the Maxim incandescent lamp (an infringement on the Edison lamp) stood second.

The full text of the Jury's Report, not yet issued, will be published in a future number of the Bulletin.

SALEM, MASS. COTTON MILL TO BE LIGHTED. We are installing in the Naumkeag Mills, at Salem, Mass., a plant consisting of two dynamos and 500 A lamps.

FALL RIVER, MASS. ANOTHER COTTON MILL PLANT. We have installed a plant of one T dynamo and 105 A lamps, in the weave-rooms and offices of the Montaup Mill, Fall River, Mass. At this mill they manufacture duck of a very heavy quality in dark indigo, olive and blues, and found it difficult to get light enough from the gas manufactured on the premises. By placing one 16 candle-power lamp between two looms we have succeeded in giving them ample light for their purposes.

COTTON MILL PLANT. CORRECTION. In the 19th Bulletin we mentioned that a plant had been ordered by the National Manufacturing Company, and we stated by mistake that the location of that Company was Augusta, Ga. The correct address of the National Manufacturing Company is Nashville, Tenn.

CONTRACTS CLOSED BY THE WESTERN EDISON COMPANY. Since the last Bulletin, contracts for the following plants have been closed by the Western Edison Light Company:

(1.) A plant of one Z dynamo, 60 A lamps, for the State Institute for the Education of the Deaf and Dumb, at Jacksonville, Ill.

(2.) A plant of one L dynamo, 300 B lamps, for the Western Nail Co., Belleville, Ill.

(3.) A plant of one Z dynamo and 60 A lamps for the sawmill of the Anson Eldred Lumber & Manufacturing Co., at Fort Howard, Wisconsin.

(4.) A plant of an L dynamo, and 174 A lamps, to be installed in the packing houses of the Chicago Packing & Provision Co., at the Union Stock Yards, Chicago, Ill.

(5.) A plant of one H dynamo, 400 A lights, to be installed in the iron working shops of the Chicago, Milwaukee & St. Paul R. R. Co. at Milwaukee, Wis. This Edison plant will supersede Weston arc lights, which have heretofore been used at these shops.

The Western Edison Light Co., have also wired Mr. Edson Keith's residence in Chicago, for 191 A lamps, to be connected with the plant supplying light to Mr. Doane's residence.

They are also wiring Gen. Anson Stager's residence, in Chicago, formerly occupied by the Calumet Club, for about 150 lights.

AGAINST STORAGE BATTERIES. The following extract about storage batteries is taken from the New Haven *Register*, October 3d:

"No one in this country has a more profound knowledge of the applications of electricity than Edison, and whenever he speaks on the subject his opinion is worthy of great attention. No one needs some mode of electrical storage more than he. At his lighting station on Pearl street, New York—tho largest in the world—those immense engines are required to run all day, so that some customer may be able to light a dark cellar or turn on an occasional light. A method of storage would here come in admirably, and the Edison company stands ready to pay a very large sum for a practical apparatus. In 1879, Edison took out patents in this direction, and to day this is what he thinks of storage batteries. 'The storage battery is in my opinion a catch-penny, a sensation, a mechanism for swindling by stock companies. The storage battery is one of those peculiar things which appeal to the imagination, and no more perfect thing could be devised by stock swindlers than that very selfsame thing. The same swindle which it is designed to perpetrate upon the people of this country has already been carried out in England, and as a result people there have lost confidence in electric lighting. Just as soon as a man gets working on the secondary (storage) battery it brings out his latent capacity for lying. The receiving of money for such articles as these ought to be made an offense at law, for, if it is not a form of obtaining money by false pretenses, I don't know what is.' All this is pretty strong language and not easily got around, and as Mr. Edison is wealthy we are somewhat surprised that he has not been sued for libel if his statements were false. But Mr. Edison is not alone in this matter. Sir William Thompson when he first saw storage batteries was astonished, and received from the

French company a heavy retainer as its electrician, 'but on investigation he became convinced that there was nothing in it, and returned the retainer to the French company.'"

Evidently the writer of the above has read Mr. Edison's interview on storage batteries in the Sixteenth Bulletin.

BUENOS AYRES. TESTIMONIAL. Sometime ago we installed a plant of one Z dynamo and 60 A lamps in the iron foundry of Messrs. Schwartz & Brother, Buenos Ayres. We have recently received the following testimonial relating to this plant:

"BUENOS AIRES, 15 August, 1883.

THE EDISON ELECTRIC LIGHT CO.,
New York.

GENTLEMEN:—Having now had the Edison electric light plant you sold us in daily operation in our iron foundry for 3 months, we take sincere pleasure in stating that it fully answers all our expectations and is giving entire satisfaction in every respect.

Very truly yours,

FELIP SCHWARZ & BRO."

BANQUE DE FRANCE, PARIS. PLANT INCREASED. The installation of 60 lamps in the Banque de France, Paris, mentioned in the 15th Bulletin, has been increased to 250 lights, which will light the entire printing department of the bank.

BIJOU THEATRE, BOSTON. An amusing adaptation of the Edison light has been made at this theatre in the last act of "Virginia." The two red horns on the devil contain 16-candle lamps, which, being connected to the Edison system in the theatre, are lighted when the devil disappears upward, producing a striking effect. The entire theatre is also lighted by Edison lamps.

LARGE SUGAR REFINERY PLANT. WILLIAMSBURGH, N. Y. The installation in the new sugar refinery of Messrs. Havemeyer & Elder, mentioned in the 16th Bulletin, has for sometime been completed. The refinery, filter house and boiler house are built entirely of brick and iron and are absolutely fire proof. The warehouse is a brick structure with wooden beams and floors. The plant consists of 3 K, one L and one Z dynamos, the driving power for which is obtained from the main engines, transmitted through suitable counter shafting and belting. There are 956 lamps in circuit, distributed as follows:

	Lamps.	
Filter House:—		
Basement	21	
1st floor	56	
2d "	12	
3d "	48	
4th "	25	
5th "	35	
9th "	43	
7th "	31	
8th "	51	
9th "	24	346
Refinery:—		
Basement	44	
1st floor	20	
2d "	32	
3d "	26	
4th "	25	
5th "	16	
6th "	30	
7th "	42	

	Lamps.	
8th "	9	
9th "	25	
10th "	10	280
Boiler and pump house		66
Warehouse:—		
Basement	48	
1st floor	67	
2d "	44	
3d "	35	
4th "	35	
5th "	35	264
Total number of lamps		956

The installation of these lamps required the placing of 25,000 feet of moulding, 425 feet of electric tube, and 3,200 lbs. of copper wire. Seventy-five lights were started May 29th, and the remainder have been added daily as the work progressed.

The dynamos are controlled by one automatic regulator, which regulates the electrical pressure throughout the entire system.

NEW ORLEANS. PLANT FOR REFRIGERATING WAREHOUSE. We have installed a plant of one dynamo and 50 A lamps in the cold storage warehouse of the New Orleans Refrigerator Company at New Orleans.

LONDON. THE "MALABAR" LIGHTED. We take the following extract from the *Morning Post*, London, August 9th, relating to the lighting of this vessel:

"This evening H. M. S. Malabar, the Indian troopship, was successfully lighted throughout with Edison's incandescent light, with which all the Indian troopers are to be fitted. The ship, from stem to stern, from stoke-hole to yard-

arm, is lighted with 400 lamps, 114 being sixteen candles and 286 eight candles. There are 66 on the saloon deck, 12 of which are police lamps, which will burn continuously, and there are others similar in different parts of the vessel. Every lamp is fitted with a fusible plug of lead wire, which will become fused directly the current exceeds the safe limit, and so the light be immediately cut off without the others being affected. The light is divided into 14 circuits; at each end of the yard-arms are reflectors, which will have eight lamps of 32 candles. On Friday the Admiralty officials will come down for a run in the Malabar. There will be only time to complete one more of the Indian troop-ships before the trooping season commences."

PHILADELPHIA. STEEL WORKS LIGHTED. We have installed a plant of one T dynamo and 100 A lamps in the Midvale Steel Works, Philadelphia.

ENGLISH STEAMSHIP PLANT. The English Edison Company has received an order from the Peninsular & Oriental Steam Navigation Company to light the steamship "Valetta," at present building on the Clyde, with two L dynamos and about 250 A lamps.

THE LOUISVILLE EXPOSITION PLANT. This is the first Exposition building ever lighted throughout by incandescent lamps. To light such a vast structure, whether by gas or electricity, presents the most difficult problem in artificial illumination. Not only must the vast area be brilliantly and uniformly lighted, but each of the exhibits, including canopied and inclosed places, must have equal and complete illumination. Besides these, there are the Art Gallery, the entrances to the building, and the special exhibits, each presenting its own peculiar difficulties. The Edison Company for Isolated Lighting undertook to solve this problem, as presented at the Louisville Exposition building, and to do it by means of the Edison system, believing that they could light the structure more brilliantly, uniformly and better in every way than it could be lighted by gas, by electric arc lights, or by any other system of artificial

light. The result confirms their belief. By universal consent, the Louisville Exposition, lit by the Edison incandescent lamps, is the best lighted structure of its size ever illuminated by artificial light.

The Southern Exposition building is one of the largest structures of its kind ever built, the area of the main building being 677,400 square feet, with an average interior height of 40 feet. To illumine this vast space the Edison Company have installed 3,998 sixteen-candle Edison lamps, equal to 63,968 candles, an average of 175 square feet per lamp. The estimate given by gas officials for lighting the same area was one six-foot burner to each 45 square feet. Not only does the Edison estimate compare favorably in regard to figures, but, in the opinion of the public, the building is lighted far more satisfactorily than could be done by the same number of gas jets. Estimates were made by various gas experts to light the building with gas, but they called for from 7,000 to 12,000 gas jets to accomplish the results attained by the Edison Company with less than 4,000 lamps.

This immense plant was described in the 19th Bulletin, but, it may be well to recapitulate the principal figures. The contract calls for the installation of 4,600 Edison lights of 16 candle-power each. To supply these lamps fifteen dynamo-machines have been installed, together with the requisite engines to drive the same. The copper wire used for the conductors throughout the building weighs over 40,000 pounds, and would measure 40 miles in length, if stretched out in a straight line. This plant is the largest ever installed to light a single building, and is equivalent to a gas plant manufacturing 35,000 cubic feet per hour.

Grave doubts were expressed that so large a plant could be installed in such a short time as was given to the Edison Company. Expert gas men had stated that it would be impossible to light the building with gas within the time limited. The Edison plant,

however, was installed with marvellous rapidity, and completed according to agreement. The contract for this plant was signed by the Edison Company, July 3d; work was commenced July 9th, and on August 1st all the conductors had been put in place and the current was passing, supplying light to the night circuit. Even as early as July 24th, the largest part of the plant had been installed.

The total capacity of the plant is 6,000 lamps of 16 candle-power each, but there are in use only about 4,800, including those outside the building, distributed as follows:

MAIN BUILDING.

Section A, West side	95	lamps.
" " North side	85	"
" " East side	96	"
" " South side	106	"
Section B, West side	162	"
" " North side	100	"
" " East side	158	"
" " South side	114	"
Section C, West side	252	"
" " North side	132	"
" " East side	258	"
" " South side	132	"
Section D, West Side	140	"
" " North side	77	"
" " East side	152	"
" " South side	72	"
Main Gallery, West side	88	"
" " North side	52	"
" " East side	88	"
" " South side	58	"
Centre Electolier	50	"
Organ Gallery	110	"
Under Organ Gallery	112	"
Concert Hall	170	"
Band Room	4	"
Galleries south of centre	108	"
Under Gallery south of centre	102	"
5-light Electroliers south of centre	130	"
12-light Electroliers centre	336	"

Electric Light Engine Room	18	lamps.
Hydraulic Annex	18	"
Corner Towers	44	"
North Tower	94	"
Sixth street Tower	136	"
Fourth street Tower	149	"
Total Main Building	3,998	lamps.

OUTSIDE OF MAIN BUILDING.

Art Gallery	340	lamps.
Boiler Annex	36	"
Fire Annex	4	"
Entrance North Tower	15	"
Entrance Sixth street Tower	30	"
Entrance Fourth street Tower	30	"
Gate Houses	42	"
All Night Circuit	250	"
Grand total	4,745	lamps.

The plant has worked well from the first, and has given the most unqualified satisfaction to all concerned. The opinions of the public may be gathered from the following extracts of a few of the newspaper comments made during the progress of the Exposition:

Louisville Commercial, Aug. 12th:

"In the evening, as was announced would be done in yesterday's *Commercial*, the Art Gallery was lighted up. Was it beautiful? Go ask the 20,000 people who inspected it, and with one accord they will answer 'Yes' with a big Y. The soft radiance of the Edison light shone not only over fair women and brave men, it illuminated the pictures and statuary and gave to them a beauty scarcely their own, beautiful as they are."

Post, August 17th:

"The eyes of the entire scientific world have been directed to the Edison electric display at the Exposition, watching with great interest the installation of the largest plant the world has ever seen. The trial has been made, and thus far success has marked the result. It is by far the most important and interesting feature of the Exposition."

Louisville Courier-Journal, Aug. 23:

"A great deal of brimming enthusiasm, childish enthusiasm you may call it, if you please, is certainly pardonable when expended over the building and grounds of the Southern Exposition at night. For even Shelley's famous description of Queen Mab's palace—the 'Hall of Spells'—fails to convey to the mind all the intermingled beauties of the Exposition building and the park when the wires thrill throughout their circuits with the mystical energy from the dynamo-electrical machines and when, from the electroliers flows the sunlight flooding every nave and transept, and gleaming from a thousand windows far out into the circumambient darkness. It is indeed a 'Hall of Spells,' that vast building * * *. The electric lighting is a masterly charm of the Exposition * * *. It is only possible in newspaper space to touch upon the margin of this very interesting subject. The Exposition presents a constant field for study in electricity, as all its applications may be seen. No such extensive lamp illumination has been seen on earth. The great Vienna Electrical Exposition, now open, only shows 1,500 lamps. The Edison incandescent lamps in the Southern Exposition building number 4,600."

N. Y. Times, Sept. 3d:

"The illuminated building seen from the distance presents a most beautiful appearance. The building is lighted by Edison lamps. It is altogether probable that the electric lights and the night exhibition have alone saved the enterprise from a heavy loss."

Cincinnati Commercial, Sept. 3d:

"These electric lights are the one great feature of the Exposition, and they are certainly the greatest and most wonderful thing about it. During the day it is a tame place, but at night one hardly recognizes it, so gloriously brilliant and radiant has it become. Let him who wishes his first impressions of the spot to be pleasant, come when the sun has set, and he will not be disappointed * * *. In the park is the Art Gallery, which, as with the rest of the exhibition, was not complete until several weeks after the opening. At night the Edison incandescent light affords illumination, and the paintings have a richer color, brighter contrasts and softer blendings in the evening than during the day."

Cincinnati Enquirer, Sept. 4th:

"In arranging the Art Gallery the present committee seems to have considered the all important subject of light, so that even in the day time not one of the many pictures is so located as to render seeing it an impossibility. Then at night the Edison incandescent light is brought into play. Nearly

five hundred of these diminutive lamps are ranged in regular rows above the rooms, where the gas lines formerly used to run. Behind them has been placed a continuous reflector, which throws the light all directly upon the paintings and leaves the centre of the room in subdued shadow that is restful to the eye. The rays are warm and the effect upon the paintings pleasing in the extreme."

N. Y. Herald, Sept. 7th:

"In the main buildings and Art Gallery the Edison incandescent light is used, 4,600 lamps in all. The effect is wonderful, and in the Art Gallery it is particularly good."

The Studio, New York, September 15th:

"In the Art Building, all of the departments are excellently lighted, especially at night, the Edison incandescent electric light being used instead of gas. I wish the painters and owners of the pictures here could visit this gallery in the evening. They would be astonished at the wonderfully magnificent effect presented by the galleries and pictures by this system of lighting. Although the galleries are lighted admirably in the daytime, the light then can scarcely be compared to the light we have at night. The latter not only preserves all of the colors as they appear in day-light, but appears to give them added brilliancy. It is superior to day-light in that it can be concentrated upon the pictures, and at the same time be kept out of the spectators' view; it is also unaffected by any variation in brilliancy, while day-light is often dimmed by passing clouds. To compare it with gaslight is, of course, unnecessary, after finding it preferable to daylight, but one thing must not be forgotten, and that is the absence of the oppressive heat which comes from the numerous jets in a gas lighted gallery."

The installation of this large and successful plant was made under the supervision of Mr. M. F. Moore, General Manager of the Edison Company for Isolated Lighting, while the wiring, arrangement of fixtures and the distribution of the light, were under the charge of Mr. L. Stieringer, of the Edison Company.

ENGLAND. TWENTY-ONE STEAMSHIP PLANTS. We have received from the London Edison Company a list of the steamships on which the Edison light has been installed, or is in progress of installation. These steamships number 21, and the list is as follows:

NAME OF VESSEL.	ROUTE.	OWNERS.	LAMPS.
H. M. S. Malabar......	Indian Troopship	The Government...	400
" Crocodile*......	"		400
" Serapis*........	"		400
" Jumna*........	"		400
" Euphrates*......	"		400
S. S. Oregon...........	Atlantic Service..	"Guion" Line..........	500
" Tarawera...........	Australia and New Zealand..	Union S. S. Co. of New Zealand..............	150
" Waihora...........			150
" Takapuna..........			
" Clan Mac Arthur....	Liverpool and the East.......	"Clan" Line..........	150
" Clan Mac Intosh....			150
" Minerva...........	On the La Plata........	Compagnie La Platense.	180
" Apollo...........			180
" Adelaide*.........	Adelaide and Melbourne....	Adelaide S. S. Co........	150
" Valetta*..........	Southampton and the East..	Peninsular & Oriental Coy	250
" Pateena*..........	Tasmania and Australia......	Tasmanian Steam Nav. Coy	150
" Rio Pardo.........	On the La Plata.........	National Brazilian S. S. Coy............	100
" Rio Parana........			100
" Tongariro*........	London & New Zealand......	New Zealand Shipping Co.	250
" ———*.........			250
" ———*.........			250

*The vessels marked thus have not yet been completed.

CINCINNATI. PLANT FOR COLOR PRINTERS. We have received from Messrs. Russell, Morgan & Co., printers in colors at Cincinnati, an order for a plant, consisting of one dynamo and 200 A lamps, to be installed in their printing establishment.

NEW YORK CITY. BLOCK OF HOUSES TO BE WIRED. We have received from the Clarke Estate an order to wire a block of 28 houses in 73d Street, between 8th and 9th Avenues, New York City, for 2,204 Edison lamps. It is proposed to light these houses, when completed, from an Edison plant to be placed in the neighborhood.

FERRY BOAT "FANWOOD" PLANT. NEW YORK CITY. This plant, which was mentioned in the 19th Bulletin, has been running for the last six weeks. The plant consists of a Z dynamo and 59 sixteen-candle lamps distributed as follows:

Ladies' cabin, 5 electroliers, 4 lights each -	20	lamps.
Gentlemens' cabin, 5 electroliers, 4 lights each	20	"
Engine Room - - - - - - - -	4	"
Main Deck - - - - - - - -	4	"
Pilot House - - - - - - - -	2	"
Hold, Fire Room, &c. - - - - - -	9	"
Total, - - - -	59	lamps.

The power is supplied by an $8\frac{1}{2}$ x 10 Lawrence Engine, with a 7 x 8 Knowles condenser. This plant will run the total number of lamps at full candle-power on 10 pounds steam pressure in the boiler.

SANTIAGO. LARGE RESIDENCE LIGHTED. The following description of the isolated plant in the private residence of Madame Cousino, Santiago, Chili, mentioned in the Seventeenth Bulletin, has been furnished us by Mr. W. N. Stewart, under whose supervision the installation was made:

"The machinery for this plant is contained in a Swiss chālet built in one corner of the grounds, especially for this purpose. It consists of a boiler built by Robt. Wetherill & Co., Chester, Pa., two Armington & Sims engines, four Z dynamos, with feed-water heater, injector, pump, etc. The current is conveyed to house, gardens, stables, green-house, etc., by more than 2,000 feet of underground conductors, most of which is Edison electric underground tubing. The amount of current is indicated by an Ampére indicator, and the dynamos may be thrown in or out of circuit by means of a lamp line, making it a complete Central Station in miniature. There are 200 A and 120 B lamps in circuit, which illuminate the whole house, no room being without light. As the construction of the house offered unusual difficulties in wiring, much time was occupied in this branch of the installation, but it was success-

fully accomplished, and all the work is concealed and no mouldings employed. Great credit is due Mr. W. J. Clark, who superintended the entire work, for his skillful and successful labor.

The garden is lighted by lamps and reflectors placed on statuary, as well as by lamps introduced in the ornamental rockwork and fountains; while the four gate posts have each a five-light globe. In the house, the fixtures are all of fire-gilt, and of the most expensive class, mostly made to order by Bergmann & Co., from photographs of the rooms. The grand vestibule has a 24-light floral electrolier with six 3-light brackets to match, while the *salons*, music, card, billiard, dining and tea rooms have each appropriate fixtures in harmony with the decorations. The plant has been running nightly for the past three months to the entire satisfaction of Madame Cousino.

Formerly there were only 60 gas burners in the house and grounds, and these were mostly in the kitchen and servants' quarters. Madame Cousino would not have gas in the other parts of the house, on account of its bad effect on the decorations. These 60 gas jets formerly cost $200 monthly. If gas were used in the house equivalent to the amount of Edison light, the gas bills would be not less than $800 per month, without counting interest on fixtures, while the cost of the Edison light including also interest and depreciation is about $325 per month. The residence in which this plant is installed is valued at $600,000, and its contents are equally valuable."

PARIS. HOTEL DE VILLE. A PLANT INCREASED. An Edison plant of 60 lamps and a Z dynamo was installed in the chambers of the Conseil Municipal at Paris, just after the Electrical Exposition in that city in 1881. This plant has been in continual use ever since that time, and has given such satisfaction that an order has been given for a plant of 600 lamps to be installed in the new Hôtel de Ville in the chambers to be occupied by the Conseil Municipal, as well as in some other parts of the building.

BRÜNN, AUSTRIA. A FACTORY LIGHTED. A plant of 250 Edison A lamps is being installed in a factory at Brünn.

TESTIMONIAL FROM THE STAR & CRESCENT MILLING COMPANY. The following testimonial was received last spring from the Star & Crescent Milling Company, Chicago:

"Chicago, May 24th, 1883.

Western Edison Light Co.,
Chicago.

Gentlemen:—In reply to your favor of the 19th, would say that this company have been using the 'Edison' for lighting their mills for the past three months, that the light gives good satisfaction in every particular, is no trouble to operate, and is better and cheaper than gas. We take pleasure in recommending it to all parties interested.

Yours truly,
Star & Crescent Milling Co."

TESTIMONIAL FROM THE NOVELTY IRON WORKS. The following testimonial was received last spring from the Novelty Iron Works, Dubuque, Iowa:

"Dubuque, Iowa, May 26th, 1883.

Western Edison Light Co.,
Chicago, Ill.

Gentlemen: -We do not use your light during the Summer months, but were well satisfied with its working whilst in operation during the Winter months. For machine work we consider it much superior to the arc light, from its perfect steadiness, and capability of being controlled by each workman to suit his particular purpose.

Yours truly,
Novelty Iron Works."

TESTIMONIAL FROM CHICAGO. The following testimonial was received last spring from Messrs. Norton Bros. & Co., Chicago, Ill:

"Chicago, May 23rd, 1883.

Western Edison Light Co.

Dear Sirs:—We have been running the Edison light about 6 months, during which time we have had no trouble or interruptions of any nature and we are perfectly satisfied with the plant. The light is safe and reliable and we consider it much superior and cheaper than gas. A four inch belt is sufficient to run a 60-light dynamo.

Yours truly,
Norton Bros. & Co."

NEW YORK CITY. PLANT AT NIBLO'S GARDEN. The Edison installation at Niblo's Garden, as used in Messrs. Kiralfy Brothers' spectacular pantomime, "Excelsior," consists of one K dynamo, 55 volts electro-motive force, capable of supplying current for 500 eight candle-power B lamps.

At each performance of "Excelsior," the Edison lights are in use as follows: 1st act, last scene, the electric torch held by the character "Light;" 2d act, last scene, the Brooklyn Bridge; 3d act, 1st scene, the discovery of the electric spark in Volta's laboratory. In the last scene the ballet dancers are provided with wands, each having an Edison lamp on the end, and festoons of lamps are lowered from the flys above. At a given signal the entire number of lamps, 400, are lighted instantaneously, producing a magical effect of great brilliancy. To instantly light such an immense number of lamps at their proper candle-power is a very severe test on the regulating capacity of the engine, and the dynamo.

SUPPLEMENTARY TESTS OF THE INCANDESCENT LAMPS SHOWN AT THE PARIS EXHIBITION. The Report of the sub-commission of the jury of the Paris Exhibition, specially charged with the examination of incandescent lamps, has already been noticed in the Bulletin. More recently, MM. Allard, F. Le Blanc, Joubert, Potier, and H. Tresca, the French members of the experiment-commission of the jury, have published in the *Comptes Rendus* of the Academy the results of their tests made upon dynamo-machines, and upon arc and incandescent lights. After giving the numerical results of the tests made upon incandescent lamps, the authors say:

"We have already mentioned that other and more systematic experiments, the chief object of which was to measure the electrical data exactly, had been made on the four systems of lamps which we have just passed in review.

"In these experiments, the horizontal intensity only, was measured; and this at an angle of 45°. This intensity moreover, was referred to the spermaceti candle as the unit, burning 7.8 grams per hour. Nine and a half such candles are the equivalent of one carcel.

"In the following table, we give in conjunction with the numbers which we have obtained, those of the sub-commission above mentioned; all being referred to the mean spherical intensity, and to the carcel lamp, taken as unity:

COMPARISON BETWEEN THE TWO SERIES OF EXPERIMENTS.

	MAXIM LAMPS.		EDISON LAMPS.		LANE-FOX LAMPS.		SWAN LAMPS.		
	Our Results.	Special Commission.	Our Results.	Special Commission.	Our Results.	Special Commission.	Our Results.	Special. Commission.	
Ohms	43.00	41.00	130.00	137.00	28.00	27.00	31.00	33.00	32.00*
Volts	75.00	57.00	91.00	90.00	50.00	44.00	48.00	47.00	51.00
Ampères	1.74	1.38	0.70	0.65	1.77	1.59	1.55	1.47	1.76
Kilogrammeters	13.28	7.94	6.50	5.91	8.95	7.09	7.62	7.06	9.67
Mean spherical intensity	2.80	1.25	1.57	1.36	1.64	1.16	2.19	1.15	2.32
Carcels per horse-power of current in lamps	15.89	12.42	18.12	15.29	13.74	12.61	21.55	12.92	22.22

*The numbers in this column are from experiments made by the Special Commission on lamps, the intensity of which at 45° was carried up to 32 candles.

"Although these two series of experiments were made with an object entirely different, and by methods widely varying, it will be remarked how closely the numbers which were obtained, approach each other. Indeed, they agree so well that each of the four systems of lamps is sharply characterized by the electrical data which it affords.

"This agreement is even more evident when we consider that the economy becomes more and more considerable as the luminous intensity is increased. This is well shown in the three columns which give the results of the measurements with the Swan lamp. When the intensity is doubled the economy increases from 13 to 19 carcels per horse-power of current expended in the lamp.

"In a general way and for a mean spherical intensity of 1.2 carcels—a fair practical value—we may count on an effective illumination of from 12 to 13 carcels only per horse-power of current; or about 10 carcels per horse-power of mechanical work, by means of incandescent lamps.

"Electric candles furnish 40 carcels per horse-power of current; regulators nearly 100 carcels; so that, in general, we may say that the economic value of the three systems is nearly as the numbers 1, 3 and 7; always remembering that in each system the most intense lights are always the most economical."

By "mean spherical intensity" is meant the mean value of the light radiated in all directions from the filament. For the Maxim lamp the "mean spherical" is 74 per cent. of the horizontal face intensity, and 78 per cent. of the horizontal intensity at 45°. For the Edison lamp, the "mean spherical" is 98 per cent. of the horizontal face intensity, and 74 per cent. of the horizontal intensity at 45°. For the Lane-Fox and the Swan lamps, having round fibres, the "mean spherical" is 58 per cent. of the horizontal face intensity and 69 per cent. of the horizontal intensity at 45°. The Maxim lamps were tested in three groups, the first of 100, the second of 50 and the third of 25. For the first group the mean spherical intensity was 1.44 carcels (13.68 candles), for the second 2.80 carcels (26.6 candles), and for the third 3.77 carcels (35.81 candles). The Edison lamps tested were 528 in number, all run on one circuit from the large dynamo in the Exhibition. The numbers given represent the mean value of all these lamps, i. e., 1.57 carcels (14.91 candles) for the mean spherical intensity. But six Lane-Fox lamps and four Swan lamps were submitted to test, the current being supplied from an Edison 60-light dynamo. The mean spherical intensity for the Lane-Fox was 1.64 carcels (15.58 candles), and for the Swan 2.19 carcels (20.8 candles.) Comparing together the energy required by these lamps to maintain the above light-intensity, it appears that while the Edison lamp gives a mean spherical intensity of 172.14 candles per horse-power of current expended in the lamp, when burning at 14.91 candles, the Maxim gives only 150.95 candles per horse-power when burning at 26.6 candles; its economy being much less even at the higher temperature. The Lane-Fox lamp gives 130.53 candles per horse-power when burning at 15.58 candles, and the Swan 204.72 only, when burning at 20.8 candles. So far as lamp-efficiency is concerned, these results are quite as favorable to the Edison lamp, to say the least, as those of the Special Sub-Commission.

On the question of machine-efficiency the figures show that the large Edison machine when running 528 lamps—less than its full load and therefore not at its maximum economy—consumed 68.74 indicated horse-power. The Weston machine (the field fed by a Maxim machine) consumed 23 indicated horse-power for 100 lamps, 17.12 for 50 and 9.15 for 25. In the first case 56 per cent. of this power appeared in the lamps; in the second 51 per cent., and in the third 61 per cent. While in the case of the Edison dynamo 67 per cent. of the energy given by the indicator, appeared as work in the lamps.

BATESVILLE, VA. TESTIMONIAL. We print the following extracts from a letter received by us regarding one of our plants:

"MILLER MANUAL LABOR SCHOOL,
BATESVILLE, VA., Sept. 6th, 1883.

THE EDISON COMPANY FOR ISOLATED LIGHTING.

GENTLEMEN:—We are glad to report that the light is working finely. As far as I can see, it comes fully up to what was claimed for it * * *. I desire again to express my entire satisfaction with the plant, and with the fair and liberal way in which it has been installed.

Very respectfully,
C. E. VAWTER."

TROY. NEWSPAPER OFFICES LIGHTED. We have just completed the installation of a Z dynamo and 60 A lamps in the offices and composing rooms of the *Northern Budget and Troy Telegram*, belonging to Messrs. C. L. McArthur & Son, Troy, N. Y.

BOSTON. ANOTHER PLANT. We are installing a small dynamo and 25 A lamps in the saloon of Thomson H. Murch.

YPSILANTI, MICH. PAPER MILL LIGHTED. We have installed a plant, consisting of a Z dynamo and 60 A lamps, in the Mill of the Ypsilanti Paper Co. at Ypsilanti, Mich.

DANVILLE, VA. COTTON MILL PLANT. We have just completed the installation of an L dynamo and 150 A lamps at Danville, Va., in the cotton mill of the Marotock Manufacturing Company.

LONDON. PLANT INCREASED. We take the following extracts from the London *Electrician*, September, 1st:

"The Edison Company have for several months lighted a considerable portion of the Holborn Restaurant with 800 lamps, and arrangements are now in progress for laying down plant for upwards of 1,000 additional 16-candle lamps * * *. When lighted throughout, the Holborn Restaurant installation will be the largest of its kind hitherto made."

PHILADELPHIA. ANOTHER WORSTED MILL LIGHTED. A plant consisting of two L dynamos and 300 A lamps, has been installed by us in the Continental Worsted Mills, Philadelphia, belonging to Mr. George Campbell.

HOLYOKE. A THIRD ORDER FROM THE MERRICK THREAD CO. We are installing a plant of one dynamo and 300 A lamps in a new mill being erected by the Merrick Thread Co., at South Holyoke, Mass. This being the third mill lighted by us for the Merrick Thread Company, the order affords very gratifying evidence of the merits of the Edison system. We first installed a plant of 95 B lamps in No. 3 mill, in March 1882. The life of our lamps had averaged 1,635 hours when night work was discontinued, and the plant gave satisfaction in every way. One of the officers of the Merrick Thread Company stated that they formerly paid \$2.12½ per 1000 feet for gas, but that since the introduction of the Edison light, they had saved enough to pay for the plant and all cost of maintenance, including power, interest and depreciation, besides a good margin.

In September, 1882, the Merrick Thread Company completed a new mill, and gave us an order to light it. We wired the mill for 950 B lamps, and installed dynamos for 600. The others will be put in operation as fast as the mill is equipped with machinery.

The third order from the Merrick Thread Company, above mentioned, is for another new mill now being built at South Holyoke. This building is being wired for 500 lamps, of which 300 will be used as soon as we finish the installation.

SYRACUSE, N. Y. STEEL WORKS PLANT. We have recently installed in the works of the Sanderson Brothers Steel Company, at Syracuse, a plant consisting of a T dynamo and 100 A lamps.

PALMER HOUSE PLANT, CHICAGO. EXPLANATION. The following correspondence explains why the Maxim lamp, infringing the Edison patents, is to be used at the Palmer House:

"WESTERN EDISON LIGHT COMPANY,
51 and 53 Wabash Ave.

CHICAGO, October 6th, 1883.

THE EDISON ELECTRIC LIGHT COMPANY,
65 Fifth Ave., New York City.

GENTLEMEN:—We have to report a rather curious experience at the Palmer House in this city, where you are aware a sixty light Edison plant has been running for the last eighteen months—the installation having been made before this company was formed.

Without informing us, or giving us a chance to compete, the Palmer House accepted a proposition from the United States Electric Light Company to remove our plant, and install in its place a Maxim plant of more than three times its capacity.

We have good reason for believing that this exchange was made at a trifling expense to the Palmer House, and that the United States Company expects to get its compensation out of the advertising which will be given to the Maxim light, and in being able to contradict the statement which we have always made that 'no Edison plant once installed, either in this country or in Europe, had ever been removed.'

The United States people here have been much mortified at the ejection of their plant from the First National Bank, where it had been given a fair trial, and the substitution of an Edison plant in its stead.

Also at the list recently sent out from your office showing where 26 of their plants had been rejected, and many of them superseded by Edison plants.

We have perhaps no right to complain of the action taken by the Palmer House managers, as the plant was their own property and they were entitled to make any disposition of it which might seem to be to their advantage, but we felt that we at least had the right to know the reasons assigned for the change, and therefore made inquiry of the Managing Partner. His answer you will find herewith inclosed.

We regret that we were not earlier informed of this plan to take out our light, but the contract was closed before any one of us knew that a change for a larger plant was even in contemplation.

We trust, however, when their new plant gets into operation and they are given an opportunity to compare the light with that which our plant had been supplying them, and which they themselves admit to have been entirely satis.

factory; also to compare the cost and trouble of operating the Maxim plant with that of the Edison, they will regret having made what seemed to them so good a bargain without a little further investigation.

Very truly yours,

WESTERN EDISON LIGHT CO.,

per JOHN M. CLARK,

Vice President."

Mr. Howe's letter, mentioned above, is as follows:

"PALMER HOUSE,
CHICAGO, ILL., October 6th, 1883.

WESTERN EDISON LIGHT COMPANY,

Chicago, Ill.

GENTLEMEN:—In reply to your inquiry as to the reason of the removal of your light from the Palmer House, I will say that this was determined upon, not because of any trouble with your machine or apparatus, but for the reason that we were afforded an opportunity to exchange your dynamo, of 60 lights capacity, for a Maxim machine of 200 lights capacity, very advantageously to us.

As to the Edison plant exchanged by us, we are pleased to state that neither machine nor lamps had ever given us any trouble, and that the light was absolutely steady and satisfactory, and fully up to your representations in every respect

Yours truly,

WILLIS HOWE,

Managing Partner."

VIENNA. THE EDISON LIGHT AT THE EXPOSITION. We take the following extract from the *Sanitary Engineer*, New York, October 4th, regarding the Edison light at the Vienna Electrical Exposition:

"The 'Compagnie Continentale Edison' and the 'Société Electrique Edison,' of Paris, using the well-known Edison light, lamps and dynamos, illuminated a hall, parlor, two bedrooms, a dining room and a conservatory. The lights in all but the conservatory are 16 candle power, and in this they are 32 candle, all in the same 100 volt circuit; their clear, steady light is too well-known to be described here. The hallway, with eight lights, is similiar to the one above mentioned, only finished in the style of Louis XIV., with light wall and ceiling, and furniture covered with light satin and velvet; it is very brilliant-

ly illuminated with 25 lights on a rich bronze and glass chandelier; the mild shadows on the statuary due to the diffused light had a very pleasing effect. The bedroom, also in Louis XIV. style, finished in red walnut and blue satin, is illuminated with 11 lights, some of which being placed in the inside of the chandelier behind the prismatic glass ornaments, sparkled with all the colors of the rainbow. The dining room with 31 lights distributed about the room, is finished with light and dark wood panels and richly ornamented sideboards, in German Rennaissance style. In the large conservatory, with 30 lamps on the chandelier and 16 distributed along the sides, the fine illumination of the statuary, surrounded with numerous plants, is particularly noticeable."

WARE, MASS. WOOLEN MILL LIGHTED. We have received an order for a plant consisting of one dynamo and 200 A lamps, to be installed in the woolen mill of the G. H. Gilbert Manufacturing Co., at Ware, Mass.

PAWTUCKET, R. I. PLANT FOR MACHINE SHOPS. We have installed in the machine shops of the Jenks Manufacturing Co., at Pawtucket, R. I., a plant of one T dynamo and 100 A lamps.

BUFFALO. MACHINE SHOPS LIGHTED. We have installed a plant of a Z dynamo and 60 A lamps in the machine shops of the John T. Noye Manufacturing Co. at Buffalo, N. Y.

DETROIT, MICH. PLANT FOR ENGINE SHOPS. We have received an order for, and are now installing, a plant of one dynamo and 50 A lamps in the engine building shops of the Fulton Iron Works at Detroit.

PHILADELPHIA. PRAISE FOR THE "RECORD" PLANT. The Philadelphia *Record*, October 6th, speaking of the Edison isolated plant that lights the building says that "The Edison

incandescent light has proved a success in the *Record* office. Some of the lamps have been in use for more than three thousand hours without apparent injury to the carbon."

THE EDISON LIGHT ON STEAMSHIPS. We take the following extract from the September number of the New York *Electrician*:

"An Englishman, traveling around this country, says that in journeying from Boston to New York, he travelled from Fall River to New York, on the steamer Pilgrim, which is illuminated by the Edison lights. After an enthusiastic description of the steamer, he said: 'The air is good, and this is due, in part, to the fact that the use of the incandescent electric light in all parts of the ship leaves the atmosphere uncontaminated by those vapors and impurities which are thrown off from lights produced by combustion. And the incandescent light is so convenient! You enter your state-room, turn a little key in the bracket on the wall, and—presto! the place is filled with a clear, white light. This is very different from the experience you have sometimes had when your last match failed you, and you had to wait for light until the servant responded to your summons.' "

LONDON. HOUSE OF COMMONS PLANT INCREASED. We take the following extract from the London *Electrician*, September 22d:

"Mr. Shaw Lefevre has purchased the Edison plant which has been in use at the House of Commons during the past Session. He intends, owing to the success attending the existing installation, to adopt the light as a permanency, and to considerably extend its use. It will be remembered that the existing plant consists of two dynamos, and 276 lamps, with all necessary fittings. The new plant will comprise an Armington & Sims high-speed engine and two L dynamos. The total number of fresh lamps to be employed will be 214, distributed as follows:—32 ten candle-power pillar lights in the House; 48 pendant lights in division lobbies; 24 table lights in division lobbies; 32 drop lights in retiring rooms; 8 lights in vestibule at back of chair; 12 lights in lavatories; 12 lights on staircases, etc., leading to retiring rooms; 4 lights in Ministers' rooms; 12 lights in reading room, etc.; and 30 lights in reporters' room. The introduction of the Edison system into this latter room will, no doubt, be hailed with joy by those members of the Press who know what it is to be poisoned by gas."

ALBANY. EDISON LIGHT AT THE BURGESSES' CELEBRATION. One of the features at the celebration of the fiftieth anniversary of the Burgesses' Corps, Albany, October 8th, was the ball in the Armory of the Corps, which was lighted for the occasion by Edison lamps. The current for these lamps was obtained from the plant of Messrs. Weed, Parsons & Co., by means of conductors temporarily put up for the purpose.

We take the following extracts from the Albany newspapers regarding this lighting:

Daily Press and Knickerbocker, October 9th:

"From the ceiling was festooned red, white and blue streamers, forming a double canopy. In the centre was a magnificent bouquet electrolier of the Edison Electric Light Company, similar to that recently exhibited in the capitol. Loaded down with bouquets, the hues of the variegated globes, illuminated by incandescent lamps, presented a scene that is indescribable * * *. The scene presented in the Armory hall last evening was magnificent beyond description. The cold words describing the decorations, in another column, give no adequate idea of the grandeur of the surroundings, illuminated by Edison's electric light. The brilliancy of the flower reflectors in the electroliers, with their variegated colors and the soft effulgence of the electric lamps, suffused the hall with a light as genial as that of an unclouded midday sun. The plants and flowers assumed deepened hues and many of them being tropical, they looked as if springing from their native soil. The decorations, too, were rendered more beautiful by the aid of this light. The guests appeared entranced with these elegant surroundings. The most extravagant poetic imagination never conceived a more delightful scene in fairy-land than was here presented. All were rapt with admiration—the ladies especially. Never before, in this city, was there such a combination of magnificence and points of interest."

Albany Evening Journal, October 9th:

"The brilliant company which had been bidden to the ball danced in a scene not far removed from the realm of the fays. Illumination was furnished by the dazzling jets which Edison has put in harness for civilization. The choicest flowers of the hothouse made up a show which deft hands had prepared by mural decoration. The armory never looked so beautiful."

Albany Evening Post, October 13th:

"The hundreds of people who visited the armory of the Burgesses' Corps and admired the beautiful chandeliers and fixtures provided by the Edison Co., for the brilliant illumination of the Corps fixtures, little realized how much skill and experience it took to perform such marvellous work in the short space of four hours. To Mr. J. H. Vail, superintendent of the Edison Isolated Co., and Mr. L. Stieringer, the well-known expert in both gas and electric lighting, should the credit be given. The employment of men of this standard is but another demonstration of the good judgment and reliability of the Edison Co."

Sunday Press, October 14th:

"These superb light-giving decorations, (the Edison electroliers), added very much to the beauty and brilliancy of the evening celebration of the Burgesses at their armory. It is hoped that the corps will retain them, as they certainly are an attractive feature to their spacious armory."

UTICA, N. Y. SHOE FACTORY TO BE LIGHTED. We have received an order for a plant of one dynamo and 200 A lights, to be installed at Utica, in the shoe factory of Messrs. H. J. Holbrook & Co.

BALTIMORE. PLANT FOR PORK PACKING ESTABLISHMENT. We are installing a plant of one dynamo and 50 A lamps in the establishment of Jacob C. Shafer, pork packer, Baltimore, Md.

CINCINNATI. PLANT FOR CARRIAGE BUILDERS. We have sold a plant of one dynamo and 25 A lights to Messrs. Sechler & Co., carriage builders, Cincinnati.

DANVILLE, VA. COTTON MILL TO BE LIGHTED. A plant of one L dynamo and 150 A lamps is now being installed at Danville, Va., for the Riverside Cotton Mills.

CORNWALL, CANADA. PLANT DOUBLED. We mentioned in the 17th Bulletin the plant at the Cornwall Mills, belonging to the Canadian Cotton Co. This plant, consisting of 520 lamps, has given such satisfaction during the time it has been in operation, that the Canadian Cotton Co. has given us an order for two additional K dynamos and 500 A lamps, thus making their total capacity 1,020 lamps.

CARDINGTON, PA. FACTORY PLANT. Messrs. Taylor, Wolfenden & Co., have ordered from us a plant of one dynamo and 50 A lamps, to be installed at Cardington, Pa., in the cotton and woolen mill of that firm.

CARDINGTON, PA. ANOTHER FACTORY PLANT. We are installing a plant of one dynamo and 50 A lamps in the cotton and woolen mill of Messrs. Wolfenden, Shore & Co., at Cardington, Pa.

FRANKLIN, PA., OIL REFINERY TO BE LIGHTED. We are installing a plant, consisting of a small dynamo and 25 A lights, in the works of the Eclipse Lubricating Oil Co., at Franklin, Pa.

BROOKLYN, N. Y. SUGAR REFINERY PLANT INCREASED. The Brooklyn Sugar Refinery, which has been using a plant of one Z dynamo and 80 lamps, has given us an order increasing the plant to two dynamos and 400 A lamps.

MALDEN, MASS. FACTORY PLANT. We have installed in the cotton waste factory of Mr. G. K. Goulding at Malden, Mass., a plant of one dynamo and 25 A lights.

CINCINNATI. PLANT FOR FLOURING MILL. We are now placing a plant, consisting of one dynamo and 50 A lamps, in the flouring mill of Messrs Lape & Brother, Cincinnati, Ohio.

SYRACUSE. DRY GOODS STORE TO BE LIGHTED. An order has been given us for a plant of one L dynamo and 150 A lamps, to be installed at Syracuse, N. Y., in the dry goods store of Messrs. D. McCarthy & Son.

ANOTHER STEAMSHIP PLANT. An order has been received from the Oregon Railway and Navigation Co., for a plant of one L dynamo and 300 B lamps, to be installed on the steamship "Olympia," now being built at the shipyards of Mr. John Roach.

PITTSBURG, PA. THE "TIMES" PLANT. We take the following extracts from the Pittsburg *Times*, October 10th, relating to our plant installed in the offices and composing rooms of that newspaper:

"The offices of *The Times*, together with the composing and press rooms, have undergone a transformation within the past ten days as regards methods of illumination. *The Times* establishment has been fitted throughout with the latest invention of Edison in the shape of his incandescent lamp. * * * At every case in the composing room of the *Times* there has been placed an Edison incandescent lamp which sheds a brilliant, but withal soft light of sixteen-candle power. The printers are delighted with the light and say that it makes an inestimable difference from the flicker of a gas jet. * * * At each of the editorial and reportorial desks there is also placed a lamp, and all of the attaches of both departments unite in commending it as the best light ever invented by which to turn out copy. The proof readers also express their great satisfaction with the new illuminant. There are eighty-five lamps in use in the office of *The Times*, and the electrical energy, by means of which they are run, is supplied by a dynamo-machine, in charge of the engineer who runs the *Times* engine. The wires are carried from the dynamo-machine to the lamps in different parts of the building through ordinary gas pipe, and as far as the appearance of the lamps are concerned one would think they were some new fashion of gas burner until the current is turned on and the lamps lighted, when the marked difference would at once be noted. The lamps are provided with neat shades and are tasteful in appearance."

SANTIAGO. PROGRESS OF CENTRAL STATION. The Santiago Central Station is now serving 98 consumers wired for 2,500 sixteen-candle lamps, of which about 2,000 are in constant use. The current is sold through a meter, in the same way as at the Pearl Street Station in New York City. Consumers in Santiago state that they find their bills for light thirty per cent. less than they formerly were when gas was used.

SANTIAGO, CHILI. FLOUR MILL PLANT. A plant of one Z dynamo and 60 A lamps has been installed in the flour mill, house and grounds of Velazco Brothers, at Santiago, Chili.

THE BRUSH STORAGE BATTERIES AT WILLIMANTIC. The following interesting comments on the Brush-Swan plant at the Willimantic Thread Works, are from a Report, October 18th, 1883, by Mr. G. H. Bliss, Gen'l Supt. of the Western Edison Company, Chicago, of an official visit made by him the previous day at Willimantic.

The plant consists of a Brush dynamo, and Swan incandescent lamps infringing the Edison patents. The report is as follows:

"By the courtesy of Mr. Scott, Superintendent of the Thread Works, and of Mr. Whittier of the Brush-Swan Company, in charge of their plant, I was permitted, as representing the Edison Company at Chicago, to examine, yesterday, the installation at the Willimantic Thread Works.

The plant consists of one Brush 18-arc-light (2,000 c. p.) dynamo, six batteries (instead of eight, as reported), and say 311 Swan lamps. Two of the batteries, with say 95 lamps, are in the office building, and the other four, with say 216 lamps, light one floor of one mill, the batteries being located in the middle of the room. A separate lamp circuit is run from each battery to the lamps, multiple-arced like the Edison system.

Mr. Scott told me that the plant was not the property of his company, and that it was still taken care of and run by the Brush Swan representative, as an exhibition plant. He declined to speak about the economy and reliability, saying that no indicator cards had been taken, and no dynamometer tests made to determine the power used by the charging Brush dynamo, nor

had the candle-power of the lamps been measured by photometers; but added that whenever the plant was turned over to his company rigid tests would be made.

The exhibit not only requires the most constant care, Mr. Whittier having told me that he had not been able to get away for several weeks, not even of a Sunday, to see his family who were only an hour or two away; but something is ever apt to give out or break down. Last night when I was present, for instance, something having happened to prevent the lighting of one quarter of the lamps in the mill; and half the lamps in the brick building also were, for some reason, not burning. Just what had happened I could not ascertain. Mr. Whittier thought it was a defective armature, Mr. Scott thought it was the poor construction of the dynamo, while I was satisfied it was the fault of the storage batteries themselves. It seems that the charging dynamo had been running all that day, from 6.30 a. m. to 12 m. and from 1 to 5.15 p. m., all those ten hours doing nothing but pour its current into the batteries, yet all those hours were not time enough to charge the six batteries, and hence only five were used, and but a portion of the lamps lighted, a break down that had been going on, I was told, for several days.

This unreliability of the Brush batteries was an old story to me. This was the third exhibition I had seen, and all were defective. When I inspected the battery at the Brush office, Chicago, something was wrong, and the attendant said 'a lot of tacks had rattled into the battery'; at the Chicago Exposition, they said 'several ounces of solder had dropped into the battery when making connections'; and now comes the third battery, said to be 'connected to a defective armature'. However, I hardly think that this was the defect, for at 5.15 p. m. the dynamo with the same armature was turned on to the Brush arc lamps in the mill, and I was told it carried the customary load without trouble. So I have no doubt, as I have said, that the trouble was in the batteries themselves, although I do not fail to appreciate the long list of ingenious excuses required by the Brush-Swan system.

The economy of the plant, the vital question after all, I paid especial attention to. Mr. Scott never having made any tests or measurements, and the plant being still under the manipulation of an exceedingly faithful and skilled representative of the Brush-Swan Company, of course my investigation was less thorough than I had hoped, but still I learned enough, to enable me to form a decided opinion.

The four batteries used to light one floor of the mill, are placed in the centre of the room. No doubt this was done, as any one familiar with incandescent lighting will see, to diminish the quantity of copper in the conductors, and, correspondingly, the work to be done by the batteries. But the acid fumes arising from the batteries are disagreeable and unhealthy. Mr. Scott spoke of this particularly, and said the batteries would probably not be allowed to remain in their present position except temporarily, owing to the sickening odor from the acids.

Besides these fumes, there is a very disagreeable noise. While the dynamo is run to charge the batteries, it can be more plainly heard in the distant room where the batteries are located, than in the dynamo room itself. This is very objectionable, and under no circumstances, I was informed, would the batteries be allowed to remain permanently as now located. It is not the actual noise of the dynamo which is heard at the batteries, but, the current from the Brush dynamo being slightly intermittent, probably every pulsation in evolving gas gives a concussion which represents the humming sound of the dynamo. The evolution of gas is evidence of the waste of current in the battery, and between unhealthy gases and disagreeable noises, Brush Storage Batteries are not desirable for general introduction into private residences and other buildings. On opening the door to a room where the batteries were located in the brick building, the door having been closed and the batteries not having been used for some hours, I found the acid odors sickening.

The important question whether the dynamos are economical, I investigated as thoroughly as I could. Mr. Scott stated that the Brush-Swan Co. claim that the 18-arc-light-dynamo at Willimantic, each lamp giving 2000 candles, is capable of charging 8 storage batteries in 7½ hours, and that from each of them forty 16-candle lamps can be burned for 4 hours. As a fact, however, only 6 storage batteries, not 8, have been sent there. I cannot reconcile this claim with my personal observation and with the facts presented to me. Their lamp resistance, hot, is claimed to be 30 ohms. They also claim that it is possible to burn from each battery 40 lamps for 4 hours, or 160 lamps one hour, both with the same economy. Eliminating the conductivity of the wires, which is in their favor, the external circuit with 40 lamps would measure seventy-five one-hundredths of an ohm, consequently, the internal resistance of the battery being 4½ ohms, a large part of the current must be used in overcoming such internal resistance, and not more than one-seventh is available for lighting. If a larger number of lamps is put on one battery, this loss is increased, and it is evident that the availability of the battery is in the direction of a few lamps burning from each battery. This, however, would make the cost of the batteries enormous, to do even ordinary lighting. Hence, ordinarily speaking, the batteries cannot be introduced into practical use, because of their cost.

The day I was at Willimantic, the dynamo used for charging the storage batteries, being run by water-power, was operated continuously throughout the day while the mill was running, up to the hour when light was required, at which time the dynamo was switched off from the batteries and applied to the arc lights. The mill started at 6.30 a. m. and ran till noon, then started again at one p. m., and the dynamo was run all this time, in connection with the batteries, which were not then being used, until 5.15 p. m., when it was switched on to the arc lights, and the storage batteries were simultaneously availed of for the Swan incandescent lamps. Thus the total time used in charging the storage batteries on the 17th inst. was 9¼ hours. The Swan

lamps in the mill burned for only about an hour, beginning at 5.15 p. m., thereby making 162 lamp hours, while the 50 lights in the office building, I was informed, burned from 5.15 till 8.15, or 3 hours, making 150 lamp hours. Mr. Whittier claimed that the mill lights were burning at 16-candles, and those in the brick building at 20-candles; but as the result of a large experience in incandescent lighting for 2 years, I differed with him, my estimate being that the mill lights burned at 8-candles and the others at 10. I have no doubt about this, and I think my large experience qualifies me to judge correctly. These 162 lamp hours at 8-candles, were equivalent to 1,296 candle-hours; while the 150 lamps hours at 10-candles, equalled 1,500 candle-hours. Total 2,796 candle-hours.

From information and personal observation, at Willimantic and elsewhere, my opinion is that 20 horse-power are needed to run the Brush-18-arc-light-dynamo, the 18 lamps being at nominally 2,000 c. p. each. On the 17th inst. one dynamo of this type was run 9¾ hours to charge the batteries, but even then it had not had time enough to charge all six batteries. Only five were charged that day, and I was told that this had been the experience for several days.

Now, to compare these figures with the economy of the Edison Light (which by the way has been in use at the same mill for nearly two years), at a very low estimate 195 horse-power applied to an Edison dynamo will yield six 16-candle lamps per horse power, which is equivalent to 1,170 lamp-hours, or 18,720 candle-hours.

It is therefore my opinion that the Brush-Swan Storage Plant at the Willimantic Mill is yielding a return in light of less than 15 per cent. of the mechanical energy applied at the dynamo, and of not more than 15 per cent. of the result to be obtained from the usual Edison Plant.

Mr. Scott stated that the Edison Plant in their mills had been working perfectly for two years, even running more lights all the time than the nominal capacity of the dynamo.

I was told that the Brush-Swan Company preferred to charge their batteries with a 4,000 candle-power current, and that they intended to change the present dynamo having a 2,000 candle current, to one with a 4,000 candle current. This is an important fact, showing that practical results have fallen far short of the Brush-Swan Co's expectations, who are now evidently discovering the fact that low tension quantity currents are more economical in charging storage batteries than high tension. But as the low tension involves a larger outlay for conductors than high tension, one of their principal claims for economy, viz: small conductors, is lost.

Mr. Whittier told me that when one of the storage batteries is fully charged, resistance is introduced in the circuit to take its place. This of course wastes power, and is another blow to the economy of the system.

The Brush switches for automatically cutting out the batteries when charged, struck me as being very crudely constructed. Carbon points are

used, making contacts which had evidently arced, and I understand that these switches have not always acted, on occasions the batteries having discharged themselves without doing work in the lamp circuit.

I have given a great deal of study and thought to the subject of Storage Batteries, believing that if such a thing as a practical, economical storage battery could be devised, it would be a valuable adjunct to incandescent lighting, but my conviction is, from all that I have seen and learned, that although storage batteries are a most interesting toy for amusing experiments, they are entirely unfit, both scientifically and commercially, for practical use."

ANNUAL STOCKHOLDER'S MEETING. EDISON ELECTRIC LIGHT COMPANY. OFFICERS ELECTED. ANNUAL REPORT. The Fifth Annual Meeting of the Stockholders of the Edison Electric Light Company was held at the office of the Company, No. 65 Fifth Avenue, N. Y. City, October 23rd, 1883. The following Officers and Directors were elected for the following year: President, S. B. Eaton; Vice President, Edward H. Johnson; Treasurer, and Secretary *pro tem.*, F. S. Hastings; Directors, Norvin Green, S. B. Eaton, G. P. Lowrey, Thomas A. Edison, J. Hood Wright, Henry Villard, James H. Banker, Calvin Goddard, Edward D. Adams, Anthony J. Thomas, J. F. de Navarro, Edward H. Johnson and W. H. Meadowcroft. The following Annual Report of the Board of Directors, provided for in the By-Laws, was submitted to the meeting:

"To the Stockholders of the Edison Electric Light Company:

Your Board of Directors desire to express their congratulations upon the general growth and development of the business of the Company during the past year. It was announced at the last annual meeting that the various details composing the Edison System of Electric Lighting had been perfected so far as to enable the light to be introduced and furnished to consumers, on a business basis, at the same price as gas. The experience of the year has demonstrated that the truth of this statement could be easily maintained. But, however good may have been the possibilities of our business twelve months ago, there can be no doubt that our position now is one of far higher economic strength, owing to the fact that great additional progress in cheapening and simplifying the apparatus constituting a plant, has been made during the year. Several new inventions of great commercial value have been perfected by Mr. Edison in that time, and he is at present engaged in investigations

and experiments which will no doubt result, as heretofore, in giving our Company yet greater advantages. Judging from all the past, and more especially from what has occurred during the last year, it seems certain that the Edison System of Incandescent Electric Lighting can be continuously, year by year, even further cheapened and simplified, until it shall have reached such a stage of perfection, both in an economical and mechanical sense, as will meet the anticipations of its most sanguine friends. Indeed there appears to be almost no limit to the possibilities available to inventive genius in connection with our business, and it is our great good fortune to have the exclusive services of Mr. Edison to prosecute new inventions in this vast field.

But these improvements, and the large development of the business otherwise made, have been attended with considerable expense. Your Board have deemed it bad policy to place a fixed limit on expenditures, especially on those connected with new inventions and experiments, and the result has been that the cost of maintaining and developing the business has been large. In order to meet the liabilities and future necessities of the Company, the capital stock has recently been increased, from $720,000 to $1,080,000. This increase was made by direction of the stockholders at a special meeting held at the office of the Company on the 24th of September, 1883. Thus far only 30 per cent. of this increased stock has been called in, which is probably sufficient to discharge every indebtedness against the Company, besides leaving a small margin for current expenses. However, should certain changes now under discussion be made regarding the Canadian and South American business, it may be necessary to call in additional assessments, but otherwise, your Board are of the opinion that a long time will elapse before all will be required.

The Edison Electric Illuminating Company of New York City finished its First District a year ago last August and the dynamos were started for the first time in the Pearl Street Station, in that District, on the 4th of September, 1882. Since that time the station has been running and furnishing light absolutely without a moments stop night or day. For several months after the station was started no charge was made for the light furnished to consumers, because Mr. Edison was continually making changes and improvements, without, however, interfering with the current; and the Illuminating Company wished to avoid being tied up by contracts to furnish light, until after Mr. Edison had entirely completed his observation of this first experiment of lighting a large district from a central station. It was accordingly nearly February before light was actually sold, and it was a month or two later before the system of regular monthly meter records, and of collecting monthly bills for the light, was fully inaugurated. The number of customers has steadily increased each month, as appears from the following statement prepared from the books of the Illuminating Company:

DATE.	NUMBER OF CONSUMERS.	LAMPS IN USE.	LAMPS WIRED FOR.
October 1st, 1882	59 Customers	1,284	1,626
November 1st, 1882	94 "	1,704	2,468
December 1st, 1882	203 "	3,144	4,838
January 1st, 1883	231 "	3,477	5,328
February 1st, 1883	302 "	4,131	6,161
March 1st, 1883	324 "	4,331	6,596
April 1st, 1883	361 "	4,884	7,871
May 1st, 1883	386 "	5,574	8,581
June 1st, 1883	410 "	6,466	10,268
July 1st, 1883	436* "	7,429	10,350
August 1st, 1883	443* "	7,946	10,920
September 1st, 1883	455 "	8,218	11,192
October 1st, 1883	472 "	8,573	11,555
October 17th, 1883	502 "	9,811	12,379

*The reason for the difference between these figures and those in the 19th Bulletin is that complete reports had not been made at the time of going to press.

The capacity of the station is now taxed nearly to its utmost, in order to supply the demand for the light from existing customers, and but few new consumers are now being connected. Mr. Edison, however, is engaged in making certain newly invented changes in the dynamo, which if successful, will augment the capacity of each present machine, thereby admitting of supplying additional customers without further outlay. But as matters stand to-day, the demand for the light exceeds the supply.

In this connection it is gratifying to recall something of the history of the great achievement which this commercial success implies. In 1879 a select committee of the British House of Commons called before it many of the first scientific men of Great Britain who unanimously declared their disbelief in the possibility of any subdivision of the electric light with economy. At this moment Mr. Edison, who had already accomplished this subdivision on principles which he believed were capable of economical application, was engaged in his laboratory upon the great and complex task which he had set for himself. That task was to devise and put in successful operation commercially, a system by which electrical currents could be generated and distributed from a central place to all the houses in a town or other given area, there to be without danger or inconvenience turned by the householder at will into a light, healthful and agreeable to the eye, in quantity suitable to domestic habits and necessities, and for a price which the consumer would be able and willing to pay, and which would return a satisfactory profit to the investor. This task in all its conditions has been accomplished, and the first central station is now regularly lighting its district at a profit which should enable it to pay a small dividend upon its capital early in the coming year,

while after the first year, large dividends can doubtless be permanently maintained. By the experience thus gained the outlay for all future central stations of similar character will be greatly reduced.

The general growth and development of the business during the past year, as stated at the beginning of this report, has been satisfactory. Marked progress in every direction has been made. Beginning with the dynamo, and ending with the house fixtures, and the lamp, including the meter, conductors, safety appliances and other important mechanical details, there have been improvements everywhere, and one of the most gratifying facts is that not only has the efficiency of the Edison System been continuously perfected, but the cost has been decreased. Our acknowlegments are due not only to Mr. Edison, who has continued to serve the Company with the same untiring zeal and great ability that he has always displayed, but also to his assistants, to whom your Trustees gladly take this occasion of expressing their high recognition of their efforts. Judging from the progress that has been made during the last year, it would not be extravagant to expect equal progress, as regards the efficiency and economy of the apparatus, during the year to come, thereby giving the Company still further advantages, in addition to those already obtained, to compete with gas and all other existing artificial lights.

No especial progress has been made with the Edison Electric Railway since the last annual meeting. The development of the Edison Light, with its attendant demands upon Mr. Edison's time and thought, has left him no leisure for perfecting the details of his System of Electric Railways. Meantime, however, other inventors, adopting to a more or less extent Mr. Edison's line of inventions, were, it was found, developing rival systems, and were enlisting capital and business men in their enterprises; and your directors, recognizing that fact, were accordingly disposed to consider certain overtures made in April last towards consolidating the Edison Electric Railway business with that of another organization. This resulted, May 18th, 1883, in the formation of a new company, called The Electric Railway Company of The United States, to which the electric railway patents of Mr. Edison, and those of Mr. Stephen D. Field of New York City, have been assigned, both interests receiving in payment a large share of the stock of the new company. In order to relieve the officers of The Edison Electric Light Company, and Mr. Edison, from the details both of business management and of electrical supervision, it was agreed that the Field interest should assume entire charge of all the business details of this new company, together with those relating to electrical development. The new company proposes to develop as rapidly as possible a complete railway system for practical use. Sufficient time has not yet elapsed to enable this plan to be yet carried out, consequently your directors have nothing further to report than the completion of the preliminary arrangement as above set forth.

The formation of the Edison Co. for Isolated Lighting was referred to in the last annual report. The contract between that company and the Edison Electric Light Co. was executed April 26th, 1882, the capital stock having been fixed at $500,000, of which $255,000 of fully paid unassessable stock was issued to the Edison Electric Light Co. on account of a license, and the balance was sold at par for cash, to raise money for carrying on the business. The growth of the business exceeded anticipation, and, in order to fill orders promptly and carry a necessary stock of apparatus, additional capital was required. The capital was accordingly increased from $500,000 to $1,000,000 by a vote of the stockholders of that company at a meeting held December 30, 1882. Fifty-one one-hundredths of this increased capital was, in accordance with the contract, issued to the Edison Electric Light Co., and the balance of the stock was used for raising additional money, but thus far only fifty per cent. of the par value of the increase has been called in. The Isolated Company earned a handsome profit on its business during the first year of its existance, out of which $50,000 was set aside for a 10 per cent. dividend on its stock, paid January 20th, 1883. The business of the second year, now current, compares favorably with that of the first year. The business of the Isolated Co. may be considered as firmly established on a dividend paying basis, and the future prospects for enlarged profits and increased dividends are very gratifying. Up to the present time the total number of installations made, amounts to 246 plants, aggregating 61,366 lamps.

The consolidation of the prominent electric light companies, including our own, into one interest, is a subject which has been frequently pressed upon our attention during the year. Every electric light company in the country, of any prominence, has manifested a willingness, and several have made urgent overtures to us, to amalgamate. All intimations of this kind we have courteously received and carefully examined, but in no case have your Board considered it for the interests of our Company to give any encouragement. Not only, we believe, do the Edison patents, as matter of law, endow our Company with a monopoly of incandescent lighting, but, aside from patents, our business has obtained such a start, one so far in advance of all competitors, and the record of our installations has been so uniformly successful, that the business ascendency which we have acquired is of itself sufficient, certainly for the present, to give us a practical monopoly. The one or two aspirants to the coveted position of being our competitors have thus far failed to make themselves felt by us enough to make it worth while for our Company, in the opinion of your Board, either to go to the expense of bringing suits for infringement, or to take other especial steps, aside from those of a purely business nature, to secure the advantages of our position. A broad survey of the subject, at the present time, convinces your Board that without going to the expense of litigation our Company will be able, from the enormous start and

business advantage it has already acquired, not only easily to keep at the head, but also to maintain a practical business monopoly. It must be admitted that this triumph has not been acquired without great labor and untiring devotion to the development of the business, but the results appear to fully confirm the judgment of your Board, that the best practical monopoly, owing to the peculiarities of our business, can be better acquired by rapidly and successfully developing the business of the Edison System, and introducing it into general use, than by expending money and energy on patent litigation. However, we still have our patents in reserve, and are free to begin suit upon them at any time that the Company may think best for any reason; and in the meantime Mr. Edison is continually making new inventions which are all patented for our Company, and consequently, should it be deemed best hereafter to sue infringers, our Company will be strongly equipped to do so.

Several subordinate companies, licensed by our Company, had been formed prior to the last annual meeting. They were, (1) The Edison Electric Illuminating Company, of New York City; (2) The Edison Company for Isolated Lighting; (3) The Western Edison Light Company, Chicago; (4) The Illuminating Company of the City of Santiago, Chili; and (5), The Edison Elect ic Illuminating Company of Lawrence. The progress made by the first two of these companies has already been described in this report. The other three have also become well established during the past year, and are now conducting business in a satisfactory manner. The Central Station Plant at Santiago, modelled on that of the First District in this city, is running with success; the Lawrence Company is now engaged in quadrupling its former plant, a good indication of what the stockholders in that company think of the business; while the Chicago Company, which has already done much business in selling Isolated Installations, is now engaged in making preparations for the installation of central station plants.

Besides the subordinate licensee companies above named, several other local companies have been formed, and others are now just completing their organizations. Those already formed are for the following cities, severally, viz: Brockton, Mass.; Shamokin, Pa.; Sunbury, Pa.; Fall River, Mass.; Davenport, Iowa; Appleton, Wis.; Williamsport, Pa.; and, in addition to these, companies in other cities are now being formed.

The central station installations of some of the companies mentioned above, will include aerial conductors on poles, constituting what is known in our business as Village Plants. These companies are full of promise for the future, and it is confidently believed that, from the first, they will all pay adequate dividends upon the investment. The capital has in every instance, been subscribed in the several localities, and not one dollar has been furnished, directly or indirectly, from here. In every case a license fee, payable partly in cash and the balance in stock fully paid and unassessable, has been paid to the Edison Electric Light Company, and the accumulation of stocks thus

paid, now and in the future, will ultimately create a large dividend paying fund for our Company.

As our business of Central Station lighting has developed, we have discovered that there are a large number of towns and villages where, owing chiefly to the fact that the houses are largely scattered, the system of distributing the current by underground conductors is apt to be expensive and cumbersome. In order to meet the peculiar conditions of this large class of cases, and to meet the demands for the light in villages, Mr. Edison has perfected a simple and comparatively inexpensive method of Central Station lighting adapted to communities where buildings are not compact and residences are widely distributed. This is called the Village System in contradistinction to our City Underground System, such as is in use in New York City. These Village Systems, where the current is distributed above the ground by means of pole lines, have proved entirely successful, and that branch of our business is being developed with great rapidity. The first plant of this kind was an experimental one, installed at Roselle, New Jersey, at the joint expense of the Edison Electric Light Co. and the Isolated Co., the authority for the installation having been granted, by the Light Co , at a meeting of its Directors, July 7th, 1882. This plant was installed, and light furnished to consumers throughout the town of Roselle, the bills being made out on the meter records, for several months, in order to enable your Directors to become fully satisfied touching the merits of village plants. As a consequence, the business having first been thoroughly tested at our expense as above set forth, permission was granted to several subordinate, licensee companies, notably the two organizations at Shamokin and Sunbury, to install similar village plants, and contracts for additional installations are now in hand for fifteen other towns. One improvement introduced by Mr. Edison in the Village Systems, since the Roselle installation was made, is worthy of especial notice. At Roselle, the lamps were placed in series of three, all being necessarily turned on or off at the same time, but since that installation was made Mr. Edison has changed this feature so that the lamps in the Village Plants, are now turned on and off singly, the same as in the usual city central station plants.

From the above statement, it will be seen that in the rapid and successful development of the business of Isolated Lighting, the larger and vastly more valuable branch of our business known as Central Station Lighting, has not been neglected. The original policy of the company, viz: not to encourage the formation of local companies for central station lighting, until its practicability, economy and profitableness had been fully established, has thus far caused the development of that branch of the Company's business, to be slow. Meantime the simple and more rapidly accomplished introduction of Isolated Plants had gained especial prestige for us in that class of work. But, valuable as the business of Isolated Lighting unquestionably is, there can be no

doubt that Central Station Lighting will prove to be much the larger source of revenue.

In the Report submitted at the last annual meeting, attention was called to the subject of the manufacture of apparatus under our patents. This highly important question has received a great deal of thought and discussion by your Board, and more especially by the Executive Committee, but no change has been made from the policy in vogue one year ago, which has thus far proved satisfactory to the company and to Mr. Edison. All the manufacturing is still being done by the same outside shops that were engaged in doing it at the last annual meeting, and your Board, while entertaining no doubt that ultimately this matter will require recasting, find it inexpedient to disturb the existing arrangements, certainly for the present. It should be remembered that our Company was organized primarily for the purpose of paying the expense of Mr. Edison's experiments touching electric light, heat and power, and to take title to his inventions and patents. As yet no provision was ever made for this Company itself to conduct the business of manufacturing, and no capital has ever been raised for that purpose. In fact, the policy of the Company has thus far been merely to perform the duties of owner of the Edison patents, and to derive income from licenses and royalties thereunder. In this respect, the policy of our Company is peculiar, all the various electric arc light companies, with possibly one exception, being the owners and managers of their manufacturing business. There can be no doubt that hereafter the business of manufacturing the vast variety of apparatus incidental to complete installations of the Edison System, will be one of magnitude and a source of great profit, besides requiring large capital. Whether this Company will itself provide capital for this vast business; or whether it will adopt the policy, which it has not yet done, of giving exclusive licenses on condition of royalties being paid by the manufacturers; or, again, whether it will throw open the field to all first-class manufacturers, granting licenses to all on equal conditions, are important questions which will undoubtedly demand consideration and decision at the hands of your new Board before the close of another year.

Considering all the peculiar circumstances attending manufacturing in connection with our business, at the present time, your Board has deemed it wise to postpone until another year the final decision of the question of having the Company itself take possession and control of the manufacturing business. Meantime, valuable experience is being gained, so that when the moment arrives for finally deciding this question, it will be a comparatively easy matter. Our business is unique, the paths in which it advances and the lines of its development are new, and it is of the utmost importance that the final decision of really vital questions should be deferred to the last possible moment, in order to get the benefit of the utmost practical experience, but without, of course, waiting long enough to imperil the interests involved.

The bringing of suits against infringers of the Edison Patents is a subject which has frequently occupied our attention during the year. The policy thus far acted upon, but which may be changed at any moment when our interests seem to require it, has been already touched upon above. Formal notices of infringment, in order to fully preserve our legal rights, have been served upon the various electric light companies that clearly and undoubtedly infringe, but no suits for infringment have thus far been begun, nobody as yet having injured us enough to make it worth our while to go to the trouble and great expense of suing.

New inventions of great value are still being made by Mr. Edison. Two of his most valuable inventions in connection with our business, both in a scientific and commercial aspect, have been perfected during the past year. Two more, also of great economic value, are now in progress of completion. All of these inventions have been turned over to our company by Mr. Edison. The total number of applications for patents thus far filed by him in the United States Patent Office, amounts to 307 applications; and the total number of patents thus far granted amounts to 215 patents. All of these inventions and patents are the property of this Company.

The Canadian business has had especial attention during the year. Several isolated plants have already been installed in factories in that country, orders are expected for others, and there are gratifying indications that a number of central station plants will also be required. Owing to the peculiar provisions of the Canadian patent laws, our Company has been compelled to manufacture its apparatus for these Canadian installations, in Canada. Considerable expense has accordingly been incurred in establishing the Canadian business, but there are gratifying indications, that our investment will return satisfactory profits, even though the business be done on but a limited scale, and that if sufficient capital were applied to develop the business in a large way, the profits would undoubtedly meet the most sanguine expectations.

In South America a large number of patents, concessions and exclusive rights, have been obtained in the various countries. This branch of the business has been under the supervision of Messrs. Fabbri & Chauncey, who through their correspondents in the various South American ports, have had unusual advantages in watching and advancing our interests. Negotiations are now on foot for the formation of two large companies in South America, the details of which are necessarily reserved for the present, but there are strong prospects that large amounts in cash and stock will be secured for the treasury of our Company, in exchange for certain concessions which we have been asked to grant.

The financial condition of the Company is fully set forth in the Treasurer's report herewith submitted. Large sums of money have been spent in experiments, new inventions and patents; also considerable amounts in developing the business in both Canada and South America. Your Board have con-

sidered it unwise to peremptorily limit the expenditures in new inventions, and to hamper the development of the business by unreasonable economy. On the whole, surveying the expenditures from the formation of the Company to the present time, the outlay has not been excessive, and your Board find adequate reason for congratulation in the fact that no expensive mistakes have been made, and that, generally speaking, full value has been received for all money spent.

In conclusion, we will say that the ultimate success of our business is no longer an open question, and that it is entirely within the bounds of safety to predict that before the close of another year the public at large will fully recognize the fact, now frankly admitted by all who have investigated it, that the Edison System of Incandescent Lighting is destined to supplant all other methods of artificial illumination."

DANGER FROM GAS. An explosion of gas occurred in the green-room of the Ambigu Theatre, Paris, on April 25th, by which twenty persons were injured. * * * On April 26th, Richard McGrann was found in his bedroom at the City Hotel, Lancaster, Pa., unconscious, the room being filled with gas which was flowing from the burner. * * * James McGrath and wife were found insensible in bed at a hotel in Scranton, Pa., April 30th, the room being filled with escaping gas. It was said by the doctors that Mrs. McGrath could not live. * * * At the glue works of Baeder, Adamson & Co., Port Richmond, Philadelphia, a gas buoy exploded. A workman named Charles Austin, had his right leg torn off by the explosion. * * * Stewart Vanderbilt was found unconscious in his room at the Gerver House, Easton, Pa., May 4th, having been overcome by escaping gas. His recovery was uncertain. * * * On May 14th, Annie E. Lucas and Sallie Rue were found unconscious on the floor of their bedroom at the residence of Joseph S. Lucas, Baltimore, suffocated by escaping gas. * * * A. S. Gurney of Wareham, Mass., was found in his stateroom on the Fall River Steamer "Bristol," on May 15th, suffocated by illuminating gas which was escaping from the burner. * * * An explosion of escaping gas occurred on May 22d in the assessors' room at the City

Hall, Holyoke, Mass., by which about $200 worth of property was destroyed. A heavy black-walnut door was torn from its hinges and demolished, and portions of the heavy wood-work were hurled some distance. A gas-fitter, named Arthur M. June, was severely injured. * * * Somebody let a programme drop from the balcony of the Grand Opera House a few months ago, while Mary Anderson and her company were playing "Romeo and Juliet." It fell into one of the gas globes and caught fire. As the flame streamed up several ladies rose to their feet and one or two screams were heard. Instantly there was a hubbub in the house. Some one shouted "Sit down there's no danger." The paper had burned itself out and the excitement ended. * * * On June 28th, an explosion of gas occured at 333 Hayes St., San Francisco, Cal. Two men were severely injured; the store front of the building was torn out, and considerable damage done. * * * An explosion of gas occurred August 27th, at the Wapping Gas Works, England, whereby three men were injured. * * * On October 25th, while the gas was being drawn off from a tank at a hotel at Woodsburg, an explosion occurred by which several persons were injured, and property worth $5,000 was destroyed.

DEATHS FROM GAS. On September 28th, W. P. Winfield was found dead in his room at the Sherman House, Indianapolis, Ind., the room being filled with gas which was escaping from the fixture. * * * Albert Taft, of Burlington, Ky., was found dead in his bed on September 30th, having been suffocated by gas which had escaped from an imperfect fixture. * * * On October 6th, J. E. Spangler was found dead in bed at the Niagara House, Baltimore, Md., asphyxiated by gas with which the room was filled. * * * F. C. Burrhus was found dead in his bed October 25th, at Everett's Hotel, New York City, having been suffocated by gas.

No. 21.

DEC. 18, 1883.

TWENTY-FIRST BULLETIN.

The Edison Electric Light Company,

65 FIFTH AVENUE,

NEW YORK, December 18th, 1883.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company, and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

CONTENTS.

These papers on the Brush Storage Battery, and the Swan Lamp Patents, are printed for the information of our agents and stockholders. They are so voluminous we are obliged to devote an entire Bulletin to them, omitting the usual record of the growth of our business.

The failure of the Brush-Swan Company to redeem their prom-

ises, made periodically for the last eighteen months, to establish an economical system of interior lighting by means of their arc light plants and an incandescent lamp, has largely extinguished the public interest in the question of storing electricity, and has created a general disbelief in its practicability. It is true that they have recently installed several exhibition plants, notably in New York City and at Willimantic, but in every case these installations have either failed to give satisfaction, or have been operated not by the usual arc light dynamos, as was promised, but by new apparatus especially prepared at an additional cost, the existing arc light equipment having been found, contrary to expectation, to be unfit. This result may be disappointing to those who have made investments, but it does not surprise us. The practical availability and commercial value of storage were thoroughly explored by Mr. Edison early in his experiments in incandescent lighting, and the conclusion he then announced, that secondary batteries cannot be employed with economy and commercial success, has been verified.

Three of the following papers have appeared in previous numbers of the Bulletin. Those of Mr. Borden and Mr. Paine are now printed for the first time. The latter is of peculiar interest, because it contains the full text of Prof. Cross's Report on the Brush-Swan experimental storage plant at the Massachusetts Institute of Technology, Boston, about which a good deal has been said in New England. We believe that all of these papers, taken together, constitute the most accurate and complete presentation yet published of the subjects discussed, and that our agents will find them of great value in meeting the erroneous, not to say sensational, statements about the Brush-Swan storage system, now being put into circulation.

MR. PAINE'S PAPER.

For more than two years the subject of the storage of electrical energy has been before the public, and the interest has been intensified by two recent exhibitions of the storage system (so called) at the Willimantic Linen Company, in Connecticut. Appreciating this interest, Mr. Brush, in 1882, promised shortly to put upon the market an apparatus whereby this great desideratum could be obtained, but not until August of the present year, was this apparatus forthcoming.

Actuated by a desire to control the system in Bristol County, Mass., a company of gentlemen, under the name of the "Taunton Syndicate," obtained from the Brush Company the refusal for that territory, and are now negotiating for the control of New England. In order to ascertain the merits of the system, they submitted the circular, issued by the Brush Company, and one of the twenty-light Brush batteries to Prof. Chas. R. Cross, of the Massachusetts Institute of Technology, who has made an elaborate report, a copy of which is given below.

"REPORT OF PROF. CHARLES R. CROSS ON EXPERIMENTS WITH THE BRUSH STORAGE BATTERY, JULY-AUGUST, 1883."

No. 1

A No. 3 twenty-light Brush Storage Battery of twenty-four cells was sent to me from the factory of the Brush Electric Co. at Cleveland, and together with the "manipulator" and a number of Swan incandescent lamps was suitably installed in the laboratory of the Massachusetts Institute of Technology, Boston.

The battery and lamps were set up and connected with the dynamo machine by Mr. Nicolaus, a gentleman detailed by the Brush Co. for the purpose.

The battery was composed of four troughs containing four cells each, two of three cells each, and two separate cells, this division allowing any necessary changes in the arrangement or number of the cells used to be made readily, and also allowing several spare cells to be used as desired. The weight of one of the single cells was 79.2 lbs., and that of the whole twenty-four cells was therefore something under 1,900 lbs., since the weight of the troughs of three or four cells is somewhat less in proportion than that of the single cell.

Three sets of Swan lamps of different resistance were furnished from the factory of the Brush-Swan Co., of which the set having the highest resistance gave the most satisfactory results in my preliminary experiments. As it seemed very desirable to reach a speedy decision regarding the work of the battery, this set of lamps was used in all the succeeding tests, without attempting to see what results would be reached with the lamps of lower resistance. This matter can very readily be tested, however, in any place where the battery and lamps are used. The battery was charged by the current furnished by a No. 3 Brush two-light dynamo-machine, furnishing a current whose value was usually about nine amperes. One arc-light was included in the circuit with the battery and dynamo whenever the battery was charged.

Although this is perhaps a somewhat severe duty for a two-light machine to perform, there was no difficulty in keeping the arc-light at what was, so far as ordinary observation could show, its normal brilliancy. During those operations of charging that were carried on in the night-time, the arc-light served to illuminate the room in which the engine and dynamo were placed. It was not considered necessary to measure the power consumed in running the dynamo, as this is well-known. With a current of eight amperes this is stated in the Brush Company's "circular" to be one and three-fourths horse power. With the nine ampere current used in my experiments, the power would probably be a little under two horse power. I found that with slight instructions as to the dynamo and lamp, an ordinary engineer could take the whole care of the charging of the battery, as the "manipulator" never failed to perform its proper function of automatically throwing the battery into or out of the circuit on starting or stopping the dynamo machine. That part of the "manipulator" which is designed to throw the battery out of circuit when charged, was not used by me in my experiments, as with a two-light Brush machine of the pattern which I have, the throwing of the battery out of circuit by it would short-circuit the machine, and if through inadvertence of the attendant in charge this change was not noticed, the machine would be injured by the abnormally strong

current that would be produced under those circumstances; with the larger Brush dynamos, such as would be used in practice for charging the batteries, a self-regulating device is provided by which the current given by the machine is rendered constant whether the battery is in or out of the circuit. The meter connected with the manipulator was found, when the clock was properly regulated, to furnish a correct register of the time during which the current entered the battery in the process of charging.

Since the current is practically constant in strength, the amount of electricity entering the battery is known. From this, in connection with a knowledge of the variation in the electromotive force of the battery as its charge approaches completion, the actual electrical energy required to charge the battery can readily be found, if desired, once for all.

After the battery was set up it was put in proper condition for use by prolonged charging. The necessity for this arises from the chemical changes which take place in the battery-plates, incident to drying and exposure to the air in transportation. These changes do not occur subsequently when the battery is left to itself, since the liquid which has been placed in cells covers the plates, and thus protects them from the oxidizing effects of the air. Owing to an absolute want of knowledge as to the length of time necessary to put the cells in proper condition, a considerable time was spent before this was accomplished. The lamps used are intended to give their normal light when run with a battery or dynamo of thirty-eight volts electromotive force. The resistance when run under these conditions, that is, when heated to their proper temperature, is about thirty-eight ohms, and the current traversing each is approximately one ampere. Experiment showed that twenty-one cells of the battery furnished the proper electromotive force and current for the lamps, a smaller number giving too little light, while a larger number gave, together with an excessive brilliancy, a current so strong as to endanger the long life of the carbon filaments of the lamps, and also to shorten correspondingly the time during which the battery could keep the lamps at a proper degree of incandescence. This number of cells, twenty-one, was accordingly used in the tests.

The points which I have been especially requested to examine and report upon immediately are, (1) what quantity of electricity is necessary to fully charge the Brush twenty-light storage battery; and (2) when thus charged, for how long a time will it run twenty incandescent Swan lamps, each at a mean brilliancy of sixteen-candle power. My attention has in this connection been called to the statements made in the "circular to agents" issued by the Brush Electric Co., so that the request made is virtually to verify those statements by an impartial and rigid examination. I have done so with the following results, which I can best explain in direct connection with the statements of the circular:

(1) The figures given on page 1 of the circular are so related that a verification of one series is sufficient for all. The statement is there made that a current of eight amperes as furnished by a No. 3 Brush two-light machine, will charge two forty-light storage batteries of twenty to twenty-two cells each in twenty-four hours. The current being the same, eight amperes, it would also take the same time to charge one forty-light battery (as the batteries are placed in series), and one-half the time, or twelve hours to charge a twenty-light battery, as the plates of the latter are only half as large as those of the former, and there is only half the work to be done within the battery to charge it. A current of different strength will charge the battery in a proportional time, since the time required to charge it depends only upon the actual quantity of electricity passing through it. Where no regulating device is used with the dynamo, the current in practice and especially with a small machine, varies slightly in strength during the time of charging, partly from accidental causes, partly from the rise in electromotive force of the battery itself as the charge approaches completion. Thence in any test, the actual amount of electricity entering the battery during the whole operation of charging must be ascertained.

I have paid especial attention to the charging of the battery in two sets of experiments. Until I had learned from experience to know from the indications of my electrical instruments when the battery was properly charged, there was no certain means of determining this, so that in the first of the experiments now under consideration I prolonged the duration of the charging current somewhat longer than was necessary. In this case the charging current was continued for ten hours fifty-seven minutes, its average value being slightly over 9.2 amperes, and the total amount of electricity was 100.5 *ampere hours*, the ampere hour being the amount of electricity furnished by a current of one ampere during one hour; were the current strength to have been eight amperes only, this would imply a duration of 12.56 hours (twelve hours thirty-four minutes). From a comparison of the readings of my instruments in this case with their readings in later experiments, I am led to conclude that the battery was really charged about twenty minutes before I stopped the charging current. This would reduce the value of the charge to 96.9 ampere hours, which with a current of eight amperes would require 12.11 hours, or twelve hours seven minutes to complete the charging.

In the second case the charging current was continued for ten hours fifteen minutes, and the amount of electricity was 94.7 ampere hours. This would require a duration of 11.8 hours, or eleven hours forty-eight minutes with a current of eight amperes. In both these experiments the battery was found to be fully charged by the succeeding tests with incandescent lamps, as well as by the electrical measurements made.

The "circular" considers a current of eight amperes continued for

twelve hours, or ninety-six ampere hours, to be necessary for complete charging.

(2) The ability of the battery to furnish the necessary current for the incandescent lamps was tested by discharging it through a set of Swan incandescent lamps, usually twenty in number; noting the time during which these furnished a proper light and measuring from time to time the candle power of the lamps, as well as keeping a record of the variations in the current and electromotive force of the battery. In order to ascertain the average value of the light furnished by the lamps one of these was mounted in a dark room at one end of the bar of a Bunsen photometer, with a standard candle at the opposite end of the bar, and after applying the usual corrections to the readings taken, the actual candle power measured at any particular time was found.

From the various measurements made at different times during the time of discharge, the average candle power for that time was determined.

The particular lamp used was changed from time to time to make sure that the illuminating power of the different lamps was substantially the same, which was found to be the case.

It ought to be remarked that many lights, both incandescent lamps and gas lights which are considered to be of sixteen-candle power, will really fall short of this value if actually measured. In four tests I reached the following results, the lamps (twenty) being in each case run for four hours, and the average candle power during that time being as follows:

1st test	16.6 C. P.
2d test	16.0*
3d test	16.2*
4th test	17.8

A fifth test was also made, in which the actual photometric measurements were somewhat unsatisfactory on account of some difficulties with the apparatus, but in which the electrical variations were almost identical with those of the fourth test, and hence, the candle power of the lights must have been the same. The numbers marked with an * are those given by the tests following the charges of ten hours fifty-seven minutes and ten hours fifteen minutes, which I have particularly discussed. It appears that even in the least favorable case, the lamp can be run four hours at an average candle power of sixteen.

The average candle power of the lamps during the first three hours of the tests was as follows:

(1)	18.1
(2)	17.2*
(3)	17.4*
(4)	19.1

The candle power was at sixteen after the following times from beginning. (1) two and one-fourth hours; (2) one and three-fourths hours; (3) two and one-fourth hours; (4) three hours.

I think that with more extended experiments it would be possible to produce Swan lamps which would give even still more satisfactory results when run in connection with the battery than those employed in my experiments. A most interesting and satisfactory test was made as to the time during which the battery would keep a smaller number of lamps than twenty up to their normal brilliancy. The battery was charged as usual, and discharged through ten incandescent lamps, the same measurements being made as in previous tests. At the end of ten hours of continuous running the light of the lamps being still above twelve-candle power each, the experiment was terminated. The average candle-power during those ten hours was 18.3, and the brilliancy was above sixteen-candle power until about eight and one-half hours from the beginning. The average candle power during the first nine hours was 18.8. This result is particularly interesting as it shows the action of the battery when used as it would be in cases where only a portion of the maximum possible number of lamps are generally used at any one time.

Besides the foregoing matters there is another important and evident peculiarity of the Brush storage battery that demands notice; it is exceedingly important that the electromotive force of the battery shall diminish as slightly as possible during the whole practicable run, and that it should fall off notably only at the end of that time. Any decrease in the electromotive force causes a diminution in the current, and hence in the brilliancy of the lamps, both because of the smaller force urging the current through the circuit, and because of the increased resistance of the lamps when their temperature falls with the primary diminution of current due to a lessened electromotive force, thus a falling off in the electromotive force of from three to five volts with an initial electromotive force of thirty-eight volts will reduce the brightness of the lamps to a point considerably below their average value, the brilliancy falling to twelve or even ten candle-power. In the Brush battery this falling off occurs chiefly or often almost entirely towards the end of the operation. Thus, considering one experience which I take at random from my notes, but which is typical of all, the electromotive force of the battery of twenty-one cells at the beginning of the discharge was 37.6 volts; at the end of one hour twelve minutes, this remained unchanged; seventeen minutes later a diminution of two-tenths of a volt had occurred; in forty-nine minutes more a further diminution of two-tenths volts took place, in the next eleven minutes the electromotive force fell two-tenths more, and at the expiration of three hours from the beginning, the electromotive force had diminished but nine-tenths of a volt. During the next and last hour of the run, the falling off was more rapid, being for

this time two volts or more than twice as great as during the first three hours. This is also clearly seen, in the run of ten hours with ten lamps, in which no perceptible falling off occurred during the first two and three-fourths hours, and during the first five hours the falling off was but one and one-half volts. The total falling off during the ten hours run was under four and one-half volts, of which about two and one-half occurred during the last two hours, and two during the last hour. This remarkable constancy in the electromotive force during the period of discharge is a most valuable feature of the Brush battery. With a somewhat more complete "forming" of the battery, giving a thicker layer of the lead oxide, this constancy as well as the average candle-power during the four hours' run, could doubtless be increased.

I also desire to call attention to the great efficiency of the Swan incandescent lamps used by me. I find that using twenty-one cells of the battery with an electromotive force of 37.6 volts, a current of 19.5 amperes was sufficient to cause twenty lamps to glow with a brilliancy of seventeen candle power each.

The energy expended in doing any electrical work is found by multiplying the electromotive force expressed in volts, by the current expressed in amperes, which gives the energy expended in each second in volt-amperes or watts. This product divided by seven hundred and forty-five gives the electrical energy in horse power, what is called the electrical horse power. One electrical horse power is the amount of electrical energy that would be produced by a dynamo-machine which was absolutely perfect, and in which there were no losses of energy by friction or otherwise, by the expenditure of one mechanical horse-power.

The efficiency of such a dynamo would be 1. The efficiency of the Brush sixteen-light dynamo is eighty-two one-hundredths. With an electromotive force of 37.6 volts and a current of 19.5 amperes, the energy expended in the lamps will be seven hundred and thirty-three watts per second, the leading wires used by me being so short and of such large section that their resistance need not be considered. An electrical horse-power is seven hundred and forty-five watts per second, so that it appears that the efficiency of the Swan lamp is such that twenty lamps per electrical horse-power and giving a united light of three hundred and forty candle power can be furnished by the expenditure of less than one electrical horse power.

Another valuable peculiarity of the Swan lamp deserves mention. The peculiar shape of the carbon filament is such that the illumination is practically equal in all directions, which is not generally the case with incandescent lamps. I am unable at this time to insert all the results of my tests which, indeed, are not quite completed. I have been obliged to draw up this report in great haste in order to secure its reception at the time assigned, and have had to leave a number of interesting calculations incom-

plete But the results relating to those points to which I was especially asked to direct my attention will, I think, be clearly understood from what I have written.

August 18, 1883.

CHAS. R. CROSS."

Laying aside for a moment the consideration of matters not mentioned in the report, let us analyze this paper, making such deductions and comparisons with the Edison system as may seem proper, care being taken that no statement be made which cannot be substantiated. The aim of this article is to instruct our readers in regard to an apparatus, which, while it has its sphere of usefulness, and will prove a most valuable addition to electrical science, is far from being the "philosopher's stone," which its inventors and promoters in their zeal have claimed for it.

The writer has taken the Edison system as the illustration of the "direct" system of electric lighting, not because he is connected with that company, but because after full investigation and previous connection with other companies using arc and incandescent lights, he was led to give in his allegiance to the Edison Company, as having the most perfect, complete, and practical system of electric lighting.

With the desire that this article shall not be considered to be "personal" in any of its allusions, let us now proceed to the analysis of Prof. Cross' report.

Prof. Cross states that of three sets of lamps which he tested, that set having the highest resistance, gave the most satisfactory results. This finding agrees with that of the Sub-Commission on incandescent lamps, appointed at the Paris Electrical Exhibition in 1881. Their report states, that "the economy of light production, is greater in high resistance lamps than in those of low resistance." The Edison lamp, of the type used in manufactories, when at sixteen candles, has a resistance of 120 ohms

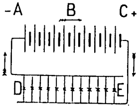
(units of resistance), while the type used in central stations has a resistance of 140 ohms. Prof. Cross finds the Swan lamp has a resistance of but 38 ohms at 16 candles.

The logical conclusion of Prof. Cross' statement would, therefore, be that the Edison lamp is more economical than the Swan, which would again coincide with the report of the Sub-Commission, which states that "the *relative* efficiency of the four lamps examined, expressed in Carcel burners of 7.4 spermaceti candles each, produced by one H. P. of current, is as follows: (A) at 16 candles, Edison 26.5; Swan 24; Lane-Fox 23.5; Maxim 20.4. (B) at 32 candles, Edison 41.5; Lane-Fox 37.4; Swan 35.5; Maxim 32.4. This factor of high resistance lamps, will again be referred to.

We find from Prof. Cross' report, that the resistance of the Brush battery is about 3 ohms. This is not stated in so many words, but can be deduced from the figures and statements therein given. We must assume that this dynamo was running at its normal speed and doing its ordinary work, for with one arc lamp placed in the circuit "this lamp appeared to be at its ordinary brilliancy." Under these circumstances, the battery must have replaced one arc lamp (which has *at least* 3 ohms resistance), for if the battery had less resistance, the dynamo would have produced more current, on the same principle that with a given pressure, a pump will discharge more water through a larger pipe or a pipe having less friction. The battery must have on the average, at least the resistance of one arc lamp, or 3 ohms. We say "on the average;" this will be explained later. Let us now apply this fact in determining the *efficiency* of the battery.

The secondary battery follows, in one respect, the same law as other generators, in that it forms part of the circuit, and its

internal resistance is a factor of the total resistance. In the pump, used as an analogy, the friction inside the pump forms part of the total friction of the water system. This will be more readily understood by aid of the following diagram:



Let A, B, C, represent the battery, with its positive pole at C, and its negative pole at A. Let C, E, D, A, represent the outer circuit with the lamps (arranged as in all incandescent circuits), represented by the crosses. Popularly speaking, the current passes from C to A through the lamps and back to C through the battery A, B, C, as indicated by the arrows. The total resistance which the current encounters must therefore be equal to the resistance of the battery (3 ohms), plus the resistance of the outer circuit, which includes the lamps.

Prof. Cross, in his experiments, used twenty lamps, each having a resistance of 38 ohms. The resistance of this outer circuit (neglecting, as does Prof. Cross, the resistance of the wires) must have been 1.9 ohms. This result may not be intelligible to all. Let us explain it. In order to obtain the best results with incandescent lamps, they must, as stated above, be arranged *between* the wires, so that the current cannot pass from one wire to the other except through the lamps, each of which forms an inde-

pendent path for the current. They are practically arranged thus:

and with twenty lamps in circuit, there would be twenty paths for the current, and the resistance would be 1-20 of 38 ohms or 1.9 ohms, as above. The resistance of the total circuit will therefore be 3 plus 1.9 — 4.9 ohms. As the various parts of a circuit "absorb" the current in direct proportion to their resistance, the battery having $\frac{3}{4.9}$ of the total resistance, must absorb 61.2 per cent. of the current, leaving but 38.8 per cent. to be utilized in the lamps. This assumption of the battery replacing the arc light by reason of its interposing an equivalent resistance would appear to be reasonable, unless there comes in some question of its counter-electromotive force which should have recognition.

The Edison dynamo follows the same laws, in this respect, as the battery, but its internal resistance is extremely low, being but .035 of an ohm on the two hundred and fifty light machines. Each Edison lamp has a resistance of 120 ohms, therefore the outer circuit will have $\frac{120}{250}$ or .48 of an ohm resistance, while the total circuit will have .515 ohms. The lamps will absorb 93.2 per cent. of the current. Allowing for friction, these dynamos will show an efficiency of 90 per cent. Assuming that the Brush dynamo has an equal efficiency (the tests at Paris, however, showed but 73 per cent. at its best), only 90 per cent. of 38.8 per cent., or 34.9 per cent. of the power furnished by the steam engines or other motive power, will appear at the Swan lamps.

This efficiency, obviously, decreases as the number of lamps is increased, and increases as the number of lamps is decreased, and

in order that the Brush storage system may show the efficiency of the Edison dynamo (90 per cent.), but one lamp must be used.

Instead of retaining the same lamp in his photometer throughout the test, Prof. Cross tells us that he changed that lamp several times, in order to ascertain the variations in candle power. He thus confounded two tests, and thus reduced the value of his experiment, for he changed his standard as many times as he changed his photometer lamp, the error of which any practical man will readily appreciate. The variations in candle power must be much greater in the Swan than in the Edison lamps, on account of the acknowledged low resistance of the Swan lamp. A change of one ohm varies the resistance of the Swan lamp 2.6 per cent., while it varies the resistance of the Edison lamp but $\frac{23}{100}$ of 1 per cent. Any variation of resistance correspondingly varies the candle power in inverse ratio.

Prof. Cross tells us that in his fourth test, during the four hours discharge of the battery, the 16-candle power lamp showed an average of 19.1 candles for the three hours and dropped to 13.9 candles for the fourth hour, giving an average of 17.8 candles for the four hours. This is an exceedingly bad showing for several reasons. As the life of an incandescent lamp varies inversely as the fourth power of the candle power (that is, a 16-candle power lamp run up to 32-candle power, will last but one-sixteenth as long as it would at 16 candles), these lamps, when run at 19.1 candles for the three hours and at 13.9 candles for the fourth hour will last but about 60 per cent. as long as they would if maintained uniformly at 16 candles. Again, the employees in any manufacturing or mercantile establishment are very sensitive about change in light, and the drop from 20 candles down to 14 would create extreme dissatisfaction. Further, a manufacturer asks for no more light than he needs. If therefore,

he asks for 16 candles he needs that amount at *all times*, and will not be contented with 14. It may be urged, as an answer, that the battery need be used for but three hours before being recharged; that is, but three-fourths of its charge need be drawn out before recharging. This is impracticable, as the first cost of the battery plant, already large, would thereby be increased 33⅓ per cent., as we must use more batteries to make up the deficiency.

In view of what has gone before, it may be interesting and instructive to enquire why the candle power of these lamps should fall, as stated above. In examining into the efficiency of the battery, we found that "the average" resistance of the battery was 3 ohms. The expression "the average resistance," together with the changing electromotive force mentioned by Prof. Cross, gives us the explanation. As is well known, a secondary battery when charged, consists of a plate of peroxide of lead (it is in the formation of this plate that we find the distinguishing feature of the Brush battery) and a plate of metallic lead, immersed in a trough of dilute sulphuric acid. As the battery discharges, the peroxide of lead is reduced to oxide, and the metallic lead also becomes oxidized. When both plates are thoroughly converted the battery is said to be discharged. In this condition its resistance is very high, for the oxide of lead is a very poor conductor, and acts as a shield, and as the charging current removes this shield by converting the oxide of lead on the positive plate into peroxide of lead, and *reduces* the oxide of lead on the negative plate to metallic lead, the internal resistance falls, and is lowest when the battery is charged. We now see why the power of the lamps is reduced as the discharge continues, for as the internal resistance increases, the battery "absorbs" more and more of the current, and a diminished amount is sent out to the lamps; in

other words, the efficiency of the battery decreases as the discharge continues.

Prof. Cross states, that inasmuch as the resistance of each lamp is but 38 ohms, and the battery has an electromotive force (or electrical pressure) of 37.6 units, he obtains more than 20 lamps of 17.0 candle power each, or 340.0 candles per electrical horse power. This is an astonishing result, inasmuch as the Sub-Commission, above alluded to, could obtain but 177.92 candles per electrical horse power from an average of ten lamps selected for them by the Swan representatives, against 196.4 candles per electrical horse power from ten Edison lamps, which the Sub-Commission themselves took at random from a stock of several hundred Edison lamps. This same committee, however, found, that by running the 16-candle power lamps up to 32 candles, they could obtain 307.25 candles for the Edison lamp, and 262.49 candles for the Swan lamp per electrical horse power. As this 262.49 approaches the result reached by Prof. Cross it would seem to prove that low candle power lamps must have been used, and driven up to 16 candles, at the expense of their life, but with much better results as to the power required, for the Sub-Commission found that it required but an increase of 28 per cent. of energy for the Edison lamp, and of 37 per cent. for the Swan lamp, to double their candle power. But admitting, for a moment, that Swan can obtain 20 lamps per electrical horse power, on account of the low efficiency of his battery and dynamo, he would obtain, in actual practice, but 6.9 lamps (34.5 per cent. of 20) per horse power. A recent expert test at the Boston "Herald" showed 8.4 Edison lamps per mechanical horse power, and a test at the Foreign Exhibition 8.88 lamps per horse power, including all friction of engine and countershafting.

There is one important statement made by Prof. Cross, which

should not be overlooked. He tells us that during the time of charging the battery an arc lamp was kept in the circuit. This was a *necessity*, and well illustrates one of the most radical defects of the system. By the internal arrangement of the Brush dynamo, a nearly constant external resistance must be used, as by decreasing the external resistance, the dynamo absorbs a larger portion of the current, and that to a dangerous degree. In that system, when running on arc lamps, the amount of power necessary is very nearly the same, at all times, as when a lamp is shut off, an equivalent and idle resistance is inserted in the lamp circuit, thus wasting power. This same necessity exists when batteries replace the lamps, for, as Prof. Cross tells us, "for charging the batteries a self-regulating device is provided by which the current given by the machines" (and consequently the work performed) "is constant, whether the battery is in or out of the circuit," and no attempt must be made to charge up less batteries than the stated capacity of the dynamos. Thus the 2-light Brush dynamo must discharge its current into at least two 20-light batteries, unless the equivalent resistance is substituted for one of them, as did Prof. Cross, who used one lamp and one battery. In the Edison system, shutting off lamps, saves power in exact proportion (not considering the friction), for as the external resistance is increased or decreased, the internal resistance is correspondingly varied by means of an automatic regulator.

The seriousness of the above defect will be better appreciated when we remember that the demands upon one battery in a given plant will vary from the demands upon another battery in the same plant, and one battery will therefore be discharged before its neighbors, but it cannot be recharged until a proper number are "emptied," so to speak, unless the idle resistance is used to

replace such batteries as are needed to make up the complement.

Leaving now the consideration of the report, let us consider some matters not mentioned therein, but which are pertinent in this connection.

In the Edison system, where one or more dynamos are used in the same plant, it is customary to so connect them that they shall deliver their currents into one and the same conductor, or, as electricians term it, the dynamos are connected in "multiple arc." By no other system of electric lighting is this possible, or at least this result has never been achieved by other than the Edison system. All the lamps are fed from the same source, and each dynamo will light any one lamp in the building, or any number of lamps up to its capacity, distributed at will over the building. In case of accident, therefore, those lights least needed can be shut off, and the power be supplied to those lamps which are essential. With the storage battery this very desirable, in fact, necessary arrangement, is impracticable. Where two generators (and the storage battery may in this connection be considered as such) are connected in multiple arc, it is necessary that the electromotive force (or electrical pressure) of one generator should not vary more than 10 per cent. from that of its mates, or in this case by more than 4 units. As the electromotive force of the battery is equal to the sum of the electromotive forces of its separate cells, each cell can vary but 1-5 of a unit from its neighbor—a result well nigh impossible in practice. These batteries must therefore deliver their currents into separate conductors; when one battery is discharged, its lamps must be disconnected and connected to another battery, thus discharging this second battery in a correspondingly shorter time, and so on; an arrangement which no practical man will tolerate in his establishment.

It may be claimed that in the event of a breakage or disarrangement of the motive power, the batteries would "tide over" the interval. But it requires ten hours to charge the battery which discharges in four hours; the chances are, therefore, more than two to one that this accident will happen during the period of charging.

Since the positive plate of the Brush battery is artificially formed from powdered lead solidified by hydraulic pressure, it depends for its consistency upon superficial, rather than molecular cohesion. Such being the case, capillary action must speedily work its dissolution, by drawing the liquid in between the granules. Indeed Mr. Brush depends upon such capillary action to render effective the increased surface which he obtains by his special method of formation, and the oxidation and deoxidation of the positive plate must cause disintegration of that plate.

The first cost of the storage battery plant must necessarily be greater than the Edison plant, even including an engine to drive the Edison dynamos; for, in addition to the batteries, there must be one or more dynamos to charge them. Moreover, on account of the low resistance and large amount of current, the Swan lamp requires 3 and 1-7 times as much wire as the Edison lamp.

Again, the running expenses must be larger in the storage system than in the Edison, for there will be ten hours' attention in the former case, against four hours in the latter.

The oil and waste and depreciation, will also be correspondingly increased.

Summing up the results obtained by the foregoing analysis, we find:

FIRST. That the Edison lamp is more economical than the Swan lamp.

SECOND. That by the storage system not more than 34 ½ per cent. of the power applied at the engine appears at the lamp, while in the Edison system, 90 per cent. of the power applied appears in actual work.

THIRD. That since the demands upon one battery are much greater than those upon another battery in the same plant, the candle power of the lamps must vary in different rooms, and different parts of the same room.

FOURTH. That every indication goes to show that lamps of low candle power (say 8 or 10 candles) were submitted to Prof. Cross, and *driven up to* 16-candle power.

FIFTH. That, on account of running the batteries separately, it is necessary to have a very complicated system of wiring.

SIXTH. That on account of the defective internal arrangement of the Brush dynamos, only a fixed number of batteries can be charged at one time without waste of power.

SEVENTH. That the very action, upon which Mr. Brush depends to render effective the large surface of his positive plate, will speedily work the dissolution of that plate.

EIGHTH. That not only is the first cost of the storage system greater than that of the Edison, but the running expenses of the former are very much in excess of the running expenses of the latter.

MR. BORDEN'S PAPER.

The Brush storage battery, that marvellous innovation so long heralded, has finally been shown to the public at the Willimantic Linen Co., Willimantic, Conn., and a report of the efficiency of the apparatus made to a syndicate of intending investors, by Prof. Chas. R. Cross, of the Massachusetts Institute of Technology.* From the statements made at the Willimantic exhibition, and from the findings of Prof. Cross' report, a copy of which fell into the hands of the writer, one is enabled to examine somewhat intelligently the outcome of deferred hopes and great expectations.

Briefly stated, Prof. Cross' report may be summed up as follows:

There was delivered to him at the Institute of Technology a battery of twenty-one elements or cells, contained in several boxes, so that he might vary its combinations, to develop current of different degrees of electromotive force.

This battery, arranged in series, he charged with the current of a 2-light machine (Brush), keeping one arc light in circuit during charging, the place of the second arc light being occupied by the storage battery, which he found fully charged in twelve and one-half hours. Prof. Cross tells the intending investors that he did not think it necessary to ascertain the power consumed by the engine that drove his dynamo, he supposed it correctly stated in the business circular of the Brush Company, and assumed it to be one and three-quarters horse-power, or perhaps more correctly, 2 horse-power.

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*The full text of Prof. Cross' report will be found on page 3.

Nor did he think accuracy required that he measure the current developed by the dynamo, which he assumes to be, as stated by the same authority, 9.1 amperes.

Neither does he state the electromotive force of the current, nor the resistance of the battery, which items ascertained, he of course had data for computing the quantity; yet with these unknown, or at any rate unexplained factors, he gravely states his finding for the efficiency of the battery to be 87 per cent.

To find the efficiency of the battery he discharged it through 20 Swan lamps, having a resistance of 38 ohms each. Three sets of lamps were furnished him, and he reports finding the greatest economy in the set having the highest resistance, which was the set mentioned above, resistance 38 ohms. In this conclusion he doubtless was correct, that being the report of the jury at the Paris Electrical Exhibition of 1881, who found the *most* economical lamp to be Edison's, whose resistance was 137 ohms. Prof. Cross finds he can get 20 Swan lamps of 16 candle-power per electrical horse-power, as each takes "about" 1 ampere of current. This hardly corresponds with the experience of the Paris investigators, but of that more hereafter.

He says an arrangement of the 21 cells, in series, gave him a discharge current having about 38 volts electromotive force. Whether this was of constant tension, or variable, 38 volts being the average, we are not informed. Inasmuch, however, as during the discharge of the battery, the lamps for the first three hours, in four separate tests, averaged respectively in candle-power 18.1, 17.2, 17.4, 19.1, and for four hours averaged 16.6, 16.0, 16.2, 17.8, then dropping suddenly to an average of 12 candle-power, it is not probable that the Brush battery differs greatly from the other accumulators, and its electromotive force varies at different stages of discharge.

It would be interesting to know if in the first hour or two the lamps were at an incandescence of 20 and 22 candle-power, but on this subject no information is vouchsafed. This question might demonstrate the absolute accuracy of the scientific gentleman making the statement of efficiency of the Swan light; and statements of his methods of determination might open a vast field of enlightenment to other investigators, who have generally found it desirable in making such tests to have a current of as constant tension as possible. If Prof. Cross has found a way to test electrical efficiency when using a current constantly and irregularly changing its electromotive force, he surely cannot intend to keep the world in ignorance of so important a discovery.

The above statement contains the most important points in Prof. Cross' report, though it would interest every one to see the whole report made public, as the writer would make it, had he the report at command. Since, however, the report was not in his hands above one hour, the principal items of information contained therein are here presented from notes. As mentioned above, the battery of 21 elements furnished current for 20 Swan lamps of varying candle-power, called 16 by Prof. Cross, during four and one-half hours, twelve and one-half hours being consumed in charging.

One other item of information may interest the reader, viz., *to insure the accuracy* of his photometric readings, Prof. Cross says he *changed* his lamp in his photometer four times *during the test.*

To arrive at a commercial value of the Brush battery, supplement the Brush report by the statements made at Willimantic by the Brush Co. representatives, and the investigator may then proceed to examine the question with sufficient data to reach results approximating accuracy, as nearly as the approximate nature of some of the information will admit.

These statements were:

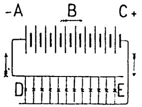
The battery for supplying the current to 40 Swan lamps of 16 candle-power, during four and a half hours, weighs one ton.

The price of the battery to run 40 Swan lamps of 16 candle-power for four and a half hours is $400, and that of the regulator for the current is $115; total, $515.

The Brush Co. guarantee that the battery is practically indestructible, and its deterioration shall not be more than five per cent. per annum.

The question first arising in an examination of the subject must naturally be: Has any mistake been made in reporting the percentage of current absorbed by the battery which is redelivered in the lamps? This is a question difficult to answer, for we are not told whether the battery had the same resistance as the arc lamp it replaced. That an approximate understanding may be had, let it be assumed that the battery had the same resistance, viz., $3\frac{1}{2}$ ohms, and that the statement of the Brush Co. is absolutely correct, the dynamo poured into it during the ten and a half hours a current of 9.1 amperes. Are the means at hand to ascertain what portion of this charge was redelivered? Such seems to be the case. It is stated that the automatic current regulator of the Brush Co. cuts off the current when the battery is charged. The circuit, then, during the discharge, consists only of the battery, the conductors and the lamps. Prof. Cross makes no account of the conductors in his calculations. Let them be neglected here, and the circuit complete consists of the battery and 20 lamps.

The following diagram will make this plain:



Since the external circuit consisted of 20 Swan lamps, having each a resistance of 38 ohms, the resistance of the external circuit was $\frac{38}{20} = 1.9$ ohms.

The resistance of the internal circuit, as already seen, was 3.5 ohms.

The total resistance of the entire circuit was $3.5 + 1.9 = 5.4$ ohms.

During the discharge of the battery, therefore, the current used in the external circuit, which is all that is available for producing light, was $\frac{1.9}{5.4}$ of the entire current, or $35\frac{1}{5}$ per cent., the rest was wasted in overcoming the resistance of the battery itself.

This is rather below the returns obtained by Tresca, in his experiments on the Faure battery in Paris. He there obtained an efficiency of 45 per cent.

Certainly, if the battery was properly supplemented in the place of the arc light it replaced, its efficiency was not 87 per cent., as Prof. Cross reported. But that gentleman may reply the resistance of the battery was less than 3.5 ohms.

Very well! If he likes that horn of the dilemma, he is welcome to it. If the battery had less than 3.5 ohms resistance, the resistance of the circuit through which the current flowed from the dynamo was reduced, and the dynamo produced more than 9.1 am-

peres of current. If the resistance of the battery was such as to make its efficiency 87 per cent. in discharging, it must have been as low as .15 ohm. In that case, the dynamo current was 17.45 amperes, or about twice what Prof. Cross assumed it to be. What a pity he did not measure the current from the machine!

It will be noticed, that if the battery had been discharged through ten lamps, assuming its resistance to have been 3.5 ohms as first stated, its efficiency would have been about 50 per cent., instead of 35 per cent. If the calculation is made at a still lower number of lamps, we shall find that the less lamps the battery maintains at incandescence the better its results. This would not be very encouraging to the man who wants to use a large number for industrial purposes of any kind.

One other assumption is possible; let us see where that leads. It may be that the element of counter-electromotive force in the battery, entered, together with its resistance, thus making its substitution for the arc light possible, and both branches of the preceding supposition fail to meet the case.

Can anything be learned of the efficiency of the system reaching the result from another side of the question? This seems possible, though again arises a regret that the engine was not indicated.

Prof. Cross assumed its work to be 2 horse-power. He thinks the battery was charged 20 minutes before he stopped the engine, or in 12 hours 14 minutes. Throw off the 14 minutes, and call it 12 hours! Then 24 horse-power-hours were delivered to the dynamo. One-half this energy went to maintainance of the arc light, then the other half, 12 horse-power-hours, or 9290 watt-hours, were used for charging the battery. But by his own showing only 2933 watt-hours of energy were delivered to the lamps in discharging the battery. Somewhere, then, between the

engine and the lamps 6357 watt-hours of energy were lost—*a loss of 68 per cent.* This is rather below that reached by supposing that the resistance of the battery only was the force opposed to the work done in its charging.

Where was the loss made?

Prof. Cross' figures indicate that his battery received but 4800 watt-hours of energy. If this be the true statement, the efficiency of the Brush dynamo is shown to be but about 50 per cent. To be sure, this representation, together with the re-delivery of 2933 watt-hours' energy by the battery, shows the efficiency of the latter to be 61 per cent. But the question arises whether the Brush Company will thank Prof. Cross for making such a demonstration, when this result for the battery involves the showing that their dynamo loses in conversion one-half of the energy applied to it.

Though the report of Prof. Cross was not written for publication in "Puck," but as a guide to a syndicate of capitalists, the temptation is irresistible to show how amusing it is, just once more.

Without using a single scientific expression, consider:

An engine delivers 2 horse-power of energy to a dynamo for a period of 12 hours, or a total of 24 horse-power-hours of energy. One-half of this goes to maintain an arc lamp during the time, the other half, or 12 horse-power-hours of energy to charge a storage battery.

The scientific gentleman making the experiment tells us he finds he can run 20 Swan lamps per horse-power of energy, and the battery maintains 20 Swan lamps at incandescence for 4½ hours in its discharge. It therefore delivers 4½ horse-power-hours of energy.

But it received 12 horse-power-hours of energy. *What has become of the other 7½ horse-powers!* Perhaps they are like the

foolish virgins of Scripture, that "took no oil with them in their lamps." Perhaps Prof. Cross is going to tell what has become of this missing energy, in the new report rumor says he is soon to give the world.

Turn next to the results obtained as to the efficiency of the Swan lamps. Prof. Cross agrees with the Paris Commission, that the higher the resistance of the lamps tested by him, the greater the efficiency obtained. From this point, however, there is a divergence of statement. The investigators at Paris found the Swan lamps furnished them by Mr. Edmunds, and having a resistance of 32.78 ohms, to have an efficiency of 10.71 lamps of 16 candle-power to the electrical horse-power. Prof. Cross finds lamps of 38 ohms have an efficiency of 20 to the electrical horse-power. How can it be accounted for? Is the explanation to be found in another part of the Paris report? There it was demonstrated that by driving the lamps, whose normal candle-power was 16, to an incandescence of 32 candles, this doubling of candle-power was obtained by an increase of but 37 per cent. in current. In view of this fact, can it be possible that by some mistake 8 candle-power lamps were given Prof. Cross, and driven by him at double their normal incandescence? This would account for their apparent efficiency. Would any other theory meet the case?

If this were the true condition of affairs, what would the effect be of this abnormal increase of candle-power? Evidently the life of the lamps would be much shortened. But how much less would the life be? Thousands of experiments made by the Edison Co. have shown that the life of a lamp is in the inverse ratio of the *fourth power* of its incandescence. Thus, if the life on an 8 candle-power lamp is 1,000 hours, when this incandescence is increased to 16 candle power, the life of the lamp will be but 122 hours. This would be an unfortunate economy of life, to accompany economy of current, such as Prof. Cross reports.

Since such reduction of the life of the lamps always accompanies abnormally high incandescence, what must be said, even supposing there may be some other explanation for the 20 lamps to the horse-power, than the only apparent one, suggested above, of the condition of affairs reported by Prof. Cross, namely, a variation between the limits of 19.1 candle-power, as a maximum, and 12 C. P. as a minimum during a single discharge? Evidently some correcting feature must be inserted, or the life of the lamps would suffer. Moreover, such variation in candle-power would be entirely inadmissible in a factory of any kind, seriously interfering with the work.

How can such correction be brought about? The only way would be by cutting out one or two cells of the battery, so reducing its electromotive force. Were this done, it is apparent, those left in the circuit would be sooner discharged than the cells cut out, and when the latter were needed again there would be found certain cells of the battery having much less electromotive force than the others.

That this is a serious matter, it would be instructive to read the remarks of Prof. George F. Barker before the American Association for the Advancement of Science, at the Montreal meeting, August, 1882.

These may be found in the "Proceedings" of that meeting, just issued, Vol. XXXI., Part 1, page 215. They are as follows:

"Another defect of considerable magnitude is developed when a number of secondary cells is placed in series, and is due to want of uniformity in their capacity for storage. This arises, first, from the difficulty of constructing them exactly alike originally; and second, from the impossibility of uniform action among them, on charge and discharge. The difference in the cells of the same battery, even when they all have been treated exactly alike, is surprising."

(Page 216.) "But this is not the worst aspect of the matter. If the discharge be continued for a longer time, some of the cells become exhausted sooner than others, *and are then charged in the inverse direction* by the current from the rest.

"Faraday said of primary batteries in 1834, that weak and exhausted charges should never be used at the same time with strong and fresh ones in the different cells; and this remark is even more applicable to secondary batteries, where this condition is more liable to occur. Not only does a dead cell introduce resistance into the circuit, but what is of more importance, its reverse polarization introduces a counter-electromotive force, so that every such cell neutralizes another cell, the dead resistance of which is also added to the circuit. In consequence, it is not safe in practice to draw from a secondary battery all the energy it should be capable of yielding, and in most cases not more than half can be safely taken out of it. In place of continuing uniform, as in a single cell, the electromotive force of a series of cells begins to fall when about half the charge it should be capable of yielding has been drawn from it. The practical result is that to supply, for lighting, a definite number of coulombs of electricity, a secondary battery of twice the size is necessary under the circumstances."

It is evident from the above, that there is a practical obstacle preventing regulation of candle-power during discharge, by varying the number of cells in circuit.

This quotation from eminent scientific authority also reveals the impracticability of connecting batteries together in multiple arc, since their electromotive force must be variable. This impossibility was recognized at Willimantic, where seven batteries were used, ***having a separate circuit*** for each 40 lamps of the 280 there installed.

This arrangement would be utterly out of the question in large installations, since any accident short-circuiting any one of the batteries would render utterly useless the 40 lamps connected with that circuit, as the entire number of lamps in the installation having no common source of supply, a sufficient number of individual lamps here and there throughout the mill or other place where such plant should be used cannot be turned out to keep the specified 40 running, however much they may be needed. And such an accident cripples the circuit for more than the ten hours necessary to re-charge the circuit.

These accidents are extremely likely to occur. In fact, so liable are accumulators to unfortunate *contretemps*, that they have,

up to the present time, never been used except in an experimental manner and on a small scale, though known to science since the beginning of the century.

Among the accidents to which storage batteries are liable may be mentioned the following, which may destroy their efficiency entirely, or impair it temporarily:

(*a*) Metallic lead, the product of electrolytic action, creeps across between the electrodes, producing short circuits in the battery.

(*b*) The sulphuric acid gradually combines with the oxide of lead, and covers the active material of the battery, so increasing its resistance.

(*c*) Local action inside the battery causes the stored energy to be rapidly dissipated.

(*d*) The exhaustion of the sulphuric acid causes a continuous change in the specific gravity of the electrolyte, which change varies the electromotive force of the battery, and the final absorption of acid by the cells causes them to cease their action.

What now of the guarantee that the Brush battery will deteriorate not more than 5 per cent. per annum? Since one has never yet lasted a year, and accidents of what nature has not been reported have happened to the battery at Willimantic, and to that in the McKee Rankin Theatre, before they were run a month, the only means of judging this matter is by ascertaining the experience of those who have had the most experience with other forms of storage batteries. This seems fair, unless the Brush batteries have fundamental and elementary differences of character, to distinguish them from others.

From the information given at the Willimantic exhibition, such radical differences of principle do not exist. These batteries were acknowledged to resemble all others for like purposes, in

having lead plates for electrodes, with finely divided lead attached thereto for accumulating the charge, which charge is brought about by the electrolysis of a weak solution of sulphuric acid.

The Brush accumulator, therefore, is subject to the laws governing the action of secondary batteries, only such modifications of those laws being applicable to them as are brought about by the peculiar mechanical methods used in their construction. Briefly, the anode and cathode are the same, and the chemical transformation produced by the current is the same as in all secondary batteries.

What, then, has been the experience of other investigators, operating with the same chemical elements, under exactly corresponding circumstances? Since these were well summed up by the intelligent New York correspondent of the Boston "Journal," in a letter to that paper, published in the issue of April 30, 1883, a quotation from that correspondence cannot be improved upon as a concise statement.

"Almost simultaneously with the report, which I mentioned a day or two ago, that the Brush Electric Light Company were getting ready to put in their storage batteries and illuminate New York with Swan incandescent lamps, come equally well authenticated reports to the effect that the value of the storage battery has been greatly exaggerated, and that it is yet nothing more than a laboratory toy of no practical value whatever. I met, yesterday, a lawyer and patent expert who was sent to Europe this winter on behalf of a number of gentlemen who thought of investing in the stock of the New York company which holds the Faure patents, supposed to be the only valid ones upon storage batteries, Brush to the contrary notwithstanding. This gentleman went to London to find out what has been done over there with it in a practical way, and has just returned. He saw Siemens, the foremost English authority upon the subject; Lockyer, who is among the best English electricians; Preece, who is at the head of British telegraph lines, and besides these scientific men of acknowledged position, he advertised for information regarding storage batteries, and questioned all practical men who had had anything to do with the matter. The result was to convince him that it would be unwise to risk money in the storage battery business. At his request Lockyer went to Scotland to find out what Sir

William Thomson's experience had been, for Sir William was among the first to give reputation to the storage battery. The story which the great investigator tells is not encouraging to investors in new scientific schemes. He has given more than a year to the study of the storage battery, and confesses that in its present condition it is useless as an economical apparatus. The trouble is that the batteries cannot be recharged more than four or five times, the lead plates disintegrate and fall to pieces after that and have to be renewed. The first result of experiments with storage batteries is to fill the experimenters with enthusiasm; then they find that there is a radical fault in the machine, but so fascinating is the affair that they say little about the snag they have struck, and work away hoping to find the remedy. For instance, out of the hundreds of batteries which Sir William Thomson has constructed within the last year and a half, three seem to stand any amount of recharging and discharging; the lead plates in these three remain intact, while all others have gone to pieces long ago. Siemens talks in about the same vein and acknowledges that the scientific world jumped at conclusions too hurriedly. Preece and Lockyer agree with these opinions; and the New York expert came back, and presented a report which has stopped all negotiations for the stock in the New York Faure Company.

These views received corroboration today. I met Prof. Barker, of the University of Pennsylvania—one of the best electricians in the country—and asked him if the storage battery was the great discovery which Brush and the Faure people had announced. Prof. Barker shrugged his shoulders, and laughed.

'There is,' he said, 'the germ of a grand discovery in it, but no one has got to it yet. The plates give out, and too much electricity has to be put into the battery in proportion to what you can get out of it to make it economical. For some purposes, when cost is of no importance, it may be used; but as to its being an apparatus for everyday use we are yet a long way off. I was requested to examine the Brush battery by some one who thought of putting money in the stock. I went up to the offices of the Brush Company, and asked to see the battery about which so much had been said. I was politely refused, there being a secret about the preparation of the plates, they said. I asked whether if I hired one of their batteries for my own use I could examine it. No, I was told, it would be locked with a heavy padlock, and I must sign an agreement not to meddle with it. This ended my investigation.'

Stephen D. Field, a practical electrician of excellent repute, who has done some good work for the Western Union Company, and a nephew of Cyrus and Dudley Field, is rather more outspoken than Prof. Barker. 'The whole thing,' he said to me to-day, 'is an attempt to make more money. The Brush lighting companies throughout the country are not making any profits. The parent company says to them "Here is the storage battery

which completes your arrangements and will make *your* whole plant pay enormously; put in some more money and it is yours." I have been at work at the battery for months, and have given it up. There is something there, but it has not been reduced to a practical shape.' "

Having thus looked somewhat in detail into the scientific facts bearing upon the Brush storage battery, in the light of the best attainable information concerning it, it may be profitable to close this paper by a brief examination of the comparative economy of this method of illumination, when placed in competition with a system of incandescent lamps run by a current direct from a dynamo, as for instance, with the Edison system.

For this purpose, let us take such a plant as that installed at the Willimantic Linen Company, where the entire number of 16 candle lamps is 280. The batteries to run this plant two hours are seven, weighing seven tons, and costing $3,535. Besides this, there is required a Brush 18-light arc machine, which has to run 10 hours to charge the battery. This dynamo costs $2,000. Since the wiring and lamps would cost approximately the same whether run on direct circuit or with battery interposed, this item may be omitted from the present calculation. The cost, then, of the battery installation, would be, in round numbers, $5,500.

The claim of power demanded to drive the Brush machine is too low, stated at 15 horse-power, as in the Brush Co. circular. It is much nearer 25. Nevertheless, that there may be no occasion for any one to complain, concede the power absorbed to be 15 horse-power. This, for 10 hours a day, would be 150 horse-power, to produce which would call for a consumption of 600 lbs. of coal, per diem, which, for 300 days, would require 90 short tons, and this, at $4 a ton, would cost $360.

The lowest amount of depreciation on the battery which can be admitted, until the error of this statement is demonstrated

by months of use, is 25 per cent.; and this is less than one-third of any result yet shown by other batteries for accumulation of electrical energy.

The expense, then, of lighting by the battery system may be stated as follows:

Coal..	$360
Depreciation and interest on dynamo at 10 per cent.......	200
Depreciation on batteries at 25 per cent.................	875
Interest on batteries at 6 per cent......................	210
Total running expenses.........	$1,645

To do this lighting by direct work, would require an Edison 300-light dynamo, worth $3,450. This would demand 35 horse-power for one hour, 70 horse-hower for two hours, a consumption of 280 lbs. of coal a day, and in 300 days 42 short tons would be used, worth at $4 $168.

Expense then of lighting direct, without the batteries, would be—

Coal..	$168
Interest and dep. on dynamo at 10 per cent.)............	345
Total cost..	$513

The running expenses therefore of the direct, when compared with the battery system, is as $513 is to $1,645, or less than one-third.

The investment to light with batteries.................	$5,500
" " " " by direct system..............	3,450

If the hours of lighting are increased to four hours, or any more than already discussed, the investment to light by the direct system does not increase, but only the coal consumed. By the storage system, however, not only the coal increases, but also the investment in dynamos and batteries.

If light is required for 4 hours the comparison would stand as follows:

INVESTMENT.

Battery System.		Direct System.	
Dynamos	$4,000	Dynamo	$3,450
Batteries	7,000		
	$11,000		

RUNNING EXPENSES.

Battery System.		Direct System.	
Coal	$ 720		
Depreciation and interest on Dynamos	400		
Depreciation on Batteries (25 per cent.)	1,750	Coal	$336
Interest on Batteries	420	Interest and depreciation on dynamos	345
Total	$3,290		$681

Note that when the lighting is extended to four hours the investment for dynamos to charge the batteries is greater than that for dynamos to light the mill direct. Hence the capacity of the charging dynamo would more than light the mill direct without the batteries, and the batteries are seen to be an encumbrance.

Even supposing, therefore, that Mr. Brush has obtained a theoretically perfect battery, the figures are enormously against him, though it were conceded there were no loss, other than the 13 per cent. admitted by the company, or the 65 per cent. that is probable.

The fact of the matter appears to be that the shorter the period of lighting required of storage batteries the greater their economy; and this reaches a maximum when they are not used at all.

(*Quod erat demonstrandum.*)

MR. BLISS' REPORT.

By the courtesy of Mr. Scott, Superintendent of the Thread Works, and of Mr. Whittier, of the Brush-Swan Company, in charge of their plant, I was permitted, as representing the Edison Company at Chicago, to examine, yesterday,* the installation at the Willimantic Thread Works.

The plant consists of one Brush 18-arc-light (2,000 c. p.) dynamo, six batteries (instead of eight, as reported), and say 311 Swan lamps. Two of the batteries, with say 95 lamps, are in the office building, and the other four, with say 216 lamps, light one floor of one mill, the batteries being located in the middle of the room. A separate lamp circuit is run from each battery to the lamps, multiple-arced like the Edison system.

Mr. Scott told me that the plant was not the property of his company, and that it was still taken care of and run by the Brush-Swan representative, as an exhibition plant. He declined to speak about the economy and reliability, saying that no indicator cards had been taken, and no dynamometer tests made to determine the power used by the charging Brush dynamo, nor had the candle-power of the lamps been measured by photometers; but added that whenever the plant was turned over to his company rigid tests would be made.

The exhibit not only requires the most constant care, Mr. Whittier having told me that he had not been able to get away for several weeks, not even of a Sunday, to see his family who were only an hour or two away; but something is ever apt to

* October 17th, 188[illegible].

give out or break down. Last night when I was present, for instance, something having happened to prevent the lighting of one-quarter of the lamps in the mill; and half the lamps in the brick building also were, for some reason, not burning. Just what had happened I could not ascertain. Mr. Whittier thought it was a defective armature, Mr. Scott thought it was the poor construction of the dynamo, while I was satisfied it was the fault of the storage batteries themselves. It seems that the charging dynamo had been running all that day, from 6.30 A. M. to 12 M. and 1 to 5.15 P. M., all those ten hours doing nothing but pour its current into the batteries, yet all those hours were not time enough to charge the six batteries, and hence only five were used, and but a portion of the lamps lighted, a break down that had been going on, I was told, for several days.

This unreliability of the Brush batteries was an old story to me. This was the third exhibition I had seen, and all were defective. When I inspected the battery at the Brush office, Chicago, something was wrong, and the attendant said "a lot of tacks had rattled into the battery;" at the Chicago Exposition, they said "several ounces of solder had dropped into the battery when making connections;" and now comes the third battery, said to be "connected to a defective armature." However, I hardly think that this was the defect, for at 5.15 P. M. the dynamo with the same armature, was turned on to the Brush arc lamps in the mill, and I was told it carried the customary load without trouble. So I have no doubt, as I have said, that the trouble was in the batteries themselves, although I do not fail to appreciate the long list of ingenious excuses required by the Brush-Swan system.

The economy of the plant, the vital question after all, I paid especial attention to. Mr. Scott never having made any tests or

measurements, and the plant being still under the manipulation of an exceedingly faithful and skilled representative of the Brush-Swan Company, of course my investigation was less thorough than I had hoped, but still I learned enough, to enable me to form a decided opinion.

The four batteries used to light one floor of the mill, are placed in the centre of the room. No doubt this was done, as any one familiar with incandescent lighting will see, to diminish the quantity of copper in the conductors, and, correspondingly, the work to be done by the batteries. But the acid fumes arising from the batteries are disagreeable and unhealthy. Mr. Scott spoke of this particularly, and said the batteries would probably not be allowed to remain in their present position except temporarily, owing to the sickening odor from the acids.

Besides these fumes, there is a very disagreeable noise. While the dynamo is run to charge the batteries, it can be more plainly heard in the distant room where the batteries are located, than in the dynamo room itself. This is very objectionable, and under no circumstances, I was informed, would the batteries be allowed to remain permanently as now located. It is not the actual noise of the dynamo which is heard at the batteries, but, the current from the Brush dynamo being slightly intermittent, probably every pulsation in evolving gas gives a concussion which represents the humming sound of the dynamo. The evolution of gas is evidence of the waste of current in the battery, and between unhealthy gases and disagreeable noises, Brush Storage Batteries are not desirable for general introduction into private residences and other buildings. On opening the door to a room where the batteries were located in the brick building, the door having been closed and the batteries not having been used for some hours, I found the acid odors sickening.

The important question whether the dynamos are economical, I investigated as thoroughly as I could. Mr. Scott stated that the Brush-Swan Co. claim that the 18-arc-light-dynamo at Willimantic, each lamp giving 2,000 candles, is capable of charging 8 storage batteries in $7\frac{1}{2}$ hours, and that from each of them forty 16-candle lamps can be burned for 4 hours. As a fact, however, only 6 storage batteries, not 8, have been sent there. I cannot reconcile this claim with my personal observation and with the facts presented to me. Their lamp resistance, hot, is claimed to be 30 ohms. They also claim that it is possible to burn from each battery 40 lamps for 4 hours, or 160 lamps one hour, both with the same economy. Eliminating the conductivity of the wires, which is in their favor, the external circuit with 40 lamps would measure seventy-five one hundredths of an ohm, consequently, the internal resistance of the battery being $4\frac{1}{2}$ ohms, a large part of the current must be used in overcoming such internal resistance, and not more than one-seventh is available for lighting. If a larger number of lamps is put on one battery, this loss is increased, and it is evident that the availability of the battery is in the direction of a few lamps burning from each battery. This, however, would make the cost of the batteries enormous, to do even ordinary lighting. Hence, ordinarily speaking, the batteries cannot be introduced into practical use, because of their cost.

The day I was at Willimantic, the dynamo used for charging the storage batteries, being run by water-power, was operated continuously throughout the day while the mill was running, up to the hour when light was required, at which time the dynamo was switched off from the batteries and applied to the arc lights. The mill started at 6.30 A. M. and ran till noon, then started again at one P. M., and the dynamo was run all this time, in

connection with the batteries, which were not then being used, until 5.15 P. M., when it was switched on to the arc lights, and the storage batteries were simultaneously availed of for the Swan incandescent lamps. Thus the total time used in charging the storage batteries on the 17th inst. was $9\frac{3}{4}$ hours. The Swan lamps in the mill burned for only about an hour, beginning at 5.15 P. M., thereby making 162 lamp hours, while the 50 lights in the office building, I was informed, burned from 5.15 till 8.15, or 3 hours, making 150 lamp hours. Mr. Whittier claimed that the mill lights were burning at 16-candles, and those in the brick building at 20-candles; but as the result of a large experience in incandescent lighting for two years, I differed with him, my estimate being that the mill lights burned at 8-candles and the others at 10. I have no doubt about this, and I think my large experience qualifies me to judge correctly. These 162 lamp hours at 8-candles, were equivalent to 1,296 candle-hours; while the 150 lamp hours at 10 candles, equalled 1,500 candle-hours. Total, 2,796 candle-hours.

From information and personal observation, at Willimantic and elsewhere, my opinion is that 20 horse-power are needed to run the Brush-18-arc-light-dynamo, the 18 lamps being at nominally 2,000 c. p. each. On the 17th inst. one dynamo of this type was run $9\frac{3}{4}$ hours to charge the batteries, but even then it had not had time enough to charge all six batteries. Only five were charged that day, and I was told that this had been the experience for several days.

Now, to compare these figures with the economy of the Edison Light which by the way has been in use at the same mill for nearly two years, at a very low estimate 195 horse-power applied to an Edison dynamo will yield six 16-candle lamps per horse power, which is equivalent to 1,170 lamp-hours, or 18,720 candle-hours.

It is therefore my opinion that the Brush-Swan Storage Plant at the Willimantic Mill is yielding a return in light of less than 15 per cent. of the mechanical energy applied at the dynamo, and of not more than 15 per cent. of the result to be obtained from the usual Edison plant.

Mr. Scott stated that the Edison plant in their mills had been working perfectly for two years, even running more lights all the time than the nominal capacity of the dynamo.

I was told that the Brush-Swan Company preferred to charge their batteries with a 4,000 candle-power current, and that they intended to change the present dynamo having a 2,000 candle current, to one with a 4,000 candle current. This is an important fact, showing that practical results have fallen far short of the Brush-Swan Co.'s expectations, who are now evidently discovering the fact that low tension quantity currents are more economical in charging storage batteries than high tension. But as the low tension involves a larger outlay for conductors than high tension, one of their principal claims for economy, viz: small conductors, is lost.

Mr. Whittier told me that when one of the storage batteries is fully charged, resistance is introduced in the circuit to take its place. This of course wastes power, and is another blow to the economy of the system.

The Brush switches for automatically cutting out the batteries when charged, struck me as being very crudely constructed. Carbon points are used, making contacts which had evidently arced, and I understand that these switches have not always acted, on occasions the batteries having discharged themselves without doing work in the lamp circuit.

I have given a great deal of study and thought to the subject of Storage Batteries, believing that if such a thing as a practical,

economical storage battery could be devised, it would be a valuable adjunct to incandescent lighting, but my conviction is, from all that I have seen and learned, that although storage batteries are a most interesting toy for amusing experiments, they are entirely unfit, both scientifically and commercially, for practical use.

MR. EDISON ON STORAGE BATTERIES.

The following interview with Mr. Edison, originally printed in the Boston *Herald*, is taken from the Sixteenth Bulletin. He spoke of storage batteries as follows:

"'Mr. Edison,' said the writer, 'what is your opinion of the utility and value of storage batteries?'

'The storage battery is, in my opinion, a catch-penny, a sensation, a mechanism for swindling by stocking companies.'

'Do you wish me to repeat in print that expression?'

'Certainly I do, and it is the truth. The storage battery is one of those peculiar things which appeal to the imagination, and no more perfect thing could be desired by stock swindlers than that very self-same thing. In 1879 I took up that question, and devised a system of placing storage batteries in houses connected to mains and charging them in the day time, to be discharged in the evening and night to run incandescent lamps. I had the thing patented in 1879 (I forget the date of the patent), but there is nothing in it. I rung all the changes on it. My plates were prepared like Plante's. The method of preparing them for charging is more tedious, but it is better than that of Faure, after preparation. You know the first storage battery was sent from France by Faure to Sir William Thomson, who was at first astounded by it. He was asked to indorse it, consented and took a retainer; but on investigation he became convinced that there was nothing in it, and returned the retainer to the French com-

pany. The fact is, the more he investigated the more he found out the fallacy of the whole business.

'On account of what Labouchère calls a swindle, this secondary battery has been used by the arc companies in England. One company alone, on the strength of an accumulator and an incandescent lamp, copied from mine by one George Lane-Fox, floated subsidiary companies, whose aggregate capital was over $30,000,000, and immense sums were paid by these companies to the parent company for rights. Within the last few months the bubble has burst, the shares upon which $25 have been paid, are offered at $1, and the swindling companies have been sued for making misrepresentations in their prospectuses as to the value of the accumulator and the right in the incandescent lamp of Mr. Fox, it appearing, from the proceedings before Mr. Justice Chitty, that another company had the right to the lamp, and this company had acknowledged that it was a piracy of the Edison lamp, and were paying royalty to the Edison company for the right to use. The action before Justice Chitty was by a stockholder in a subsidiary company to cause the return of his subscription on the above account. The judgment was in his favor.'

'But cannot electricity be stored?'

'Yes. Scientifically the thing is all right, but commercially as absolute a failure as one can imagine. You can store it and hold it; but it is gradually lost, and will all go in time. Its efficiency, after a certain number of charges have been sustained, begins to diminish, and its capacity and efficiency both diminish after a certain time in use, necessitating an increased number of batteries to maintain a constant output. Owing to corrosion of the sustaining plates of the battery, the effect of local action and other causes, too many to enumerate, the yearly depreciation of the battery is not less than 30 per cent. of its first cost, if used daily.

'The facts are, that there are two or three companies that have been organizing subsidiary arc light companies throughout this country for some time past. In this arrangement the parent company made money by selling machinery, etc., to the working companies, but the latter are not making money and have nearly ceased giving new orders. Now these parent companies, finding the call for machinery slacking, have come in with their secondary batteries. They now make this statement, which is the cleverest thing I ever heard of: "Here, gentlemen, you have a large investment in machinery, etc., for furnishing light, but are not making any money out of it. Now, we have something by which you can utilize your machinery. You can work day and night, and can do more work. You can utilize your present plant in the day time, and the electricity thus made in the day time for incandescent lighting, and in the night have your plant for arc lighting direct." That sounds good and fair, does it not? The Board of Directors discuss the offer and think it a good thing. Then they conclude to go into it.

'I will tell you where the fallacy in this arrangement lies. It consists in the fact that the cost of batteries to store this extra electricity that could be produced in the day time would be twice as much as that of the station that produced it; so that, if the company has already $100,000 invested, and agree to utilize their machinery in the day time by the addition of storage batteries, they will find that to carry out their desire it will cost them $200,000 for the batteries. I will guarantee that not one Board of Directors in a hundred will see it, and the parent company will not tell them of it until after they have purchased.

'Well, they have purchased the storage batteries, of course, at a cost of $200,000. On that investment, at the end of the first year, they have a depreciation of 30 per cent. To save them-

selves they will have to earn interest on their investment. They must also earn enough to meet the extra depreciation on their plant running through the day, and will have to spend double the amount in coal to obtain the same output from the batteries, for the reason that they interpose between the source of energy and the light, a thing in which there is a loss both in charging and discharging, and a loss in standing, and that loss increases as the battery gets older, after a certain maximum is reached.'

'What is the maximum of a storage battery?'

'It is about 50 per cent. You get the maximum of current when you utilize the full capacity of the battery, the same as in a steam engine, where, if steam is admitted for the full stroke, 50 per cent. of the steam or power is wasted, but you obtain the maximum power from the engine; but this is also the minimum of economy. Hence, to get the proper economy, engine builders only take one-third to one-fourth of the maximum power from their engines, but this adds to the investment, which is compensated for by the saving in economy, which more than pays interest on increased investment.

When they say that 90 per cent. is obtained from the battery they tell you what is scientifically true. They say they get 10 lights of 16 candles each per horse power of current from a battery. Now that is true, and it is not true. If you get a horse power of current from a battery it will give you 10 lights of 16 candles; but to get that you have to net all losses through the battery, through the wires, through the dynamo, and all that. They start off with a horse power indicated in the engine. A certain amount of this is taken to move the engine and dynamo, and a certain amount is lost in the dynamo to convert power into electricity, because no machine is perfect; a certain amount must be lost on the wire connecting the station with the secondary battery;

another amount is lost in charging the battery, due to its resistance and imperfection as a mechanism; another amount is lost during the interim between charging and use; another portion will be lost in discharging the battery through the lamps, and still another amount will be lost in the wire connecting the battery to the lamp. So that your horse power will dwindle down until it will give you only about three lamps; whereas, if you worked direct, you would probably get six lamps.'

'You are hard on the battery folks.'

'The reason I am down on these people is because I have a legitimate thing, and there is a loss of public confidence in it through their operations. We have never yet asked the public for money. Now, I don't want the people swindled, for I want our company to make money out of electric lighting in a legitimate way, by giving value for what is received, and, if it sells rights, to first prove to the purchasers their value by results obtained in actual practice upon a large commercial scale, as is now being done, and the exposure of such things would make it much easier and better for me to advance my system on its true merits.

The same swindle which it is designed to perpetrate upon the people of this country has already been carried out in England, and as a result people there have lost all confidence in electric lighting. The same people are here. They have what they call the Swan lamp, a palpable infringement on mine. We have entered suits against them in England, and will sue them here. But these people know well that it will take some time to get a suit decided, and by that time they will have "permitted the public to invest heavily."'

'Then you consider storage batteries wholly impracticable? Is there no hope for their doing good, legitimate work?'

'None whatever. Except in a very limited number of cases,

storage of gas could be made analogous to storage of electricity. One of the principal outlays of a gas company is for pipes. The average diameter of their mains is five or six inches. But, under pressure greater than they now force the gas through their mains, an inch pipe would answer under the storage principle of having a small gasometer in every house. The difference saved to the company by this arrangement would be about $15 for pipes from house to house, 25 to 30 feet apart. But the gasometer would cost a great deal more in each house than the 25 feet of pipe buried in the street. Besides, gasometers might not be just the thing in the hands of the public; there might be explosions; some of them might not have the room. The gasometer would require some little mechanism to reduce the pressure down to a limit where it could be burnt. Now, these little mechanisms are uncertain.

The general intelligence of the public, when applied to mechanism, is also uncertain; and this has probably prevented gas engineers from introducing a system of local storage. The electric arc company, which is seeking to introduce a system of storage, follows out the above idea exactly. Instead of using large conductors and low pressure electricity, as I do, they propose to save on the investment by using small conductors and high pressure electricity; and, to make this kind of electricity available, they reduce its pressure by means of a storage battery in the same way as high pressure gas in a small main could be stored in a gasometer and its pressure reduced to make it available. In the first place, the high pressure current is very dangerous to life. The depreciation on storage batteries alone, in a system of general distribution, would pay the interest on the extra copper sufficient to dispense with their use; and second, if these small wires carrying high pressure currents were to be placed underground, as all systems must be to be financially permanent in large cities, the

extra cost of the insulation necessary to prevent the leakage of the currents of so powerful a pressure would more than pay for the extra copper used in a system which carry low pressure currents, and do not require so expensive nor so great an amount of insulation. The cost of our mains is about $15.00 from house to house. These mains are two feet underground, where the intellectual portion of the public cannot reach it to improve it, while, with storage batteries, from $75 to $200 worth of batteries would be placed in each house to save about $9.00 in copper and interpose an uncertain device in which 50 per cent. of the article to be sold is lost.' Mr. Edison here paused a moment, held down his head, and, quickly raising it again, said, in his quaint way: 'Just as soon as a man gets working on the secondary battery it brings out his latent capacity for lying.'

'But suppose power was cheap, such as a water power, would it not pay to store electricity even at a great sacrifice of energy?'

'In utilizing water power, even where the cost of water is, say nearly nothing, there is still the cost of plant for storing to be considered, and interest and depreciation added. Where is the use of this outlay when, in nearly every case, by connecting the dynamo direct with the turbine you can get the same result far more cheaply? But you will remember that water power is not so cheap after all. It is only occasionally you can run across a water power that has a surplus in every month in the year beyond the wants of those who utilize it. These storage men will tell you that lamps burn better fed from batteries than from the source of power direct. This is not so. They are very brilliant when they start, but more battery must be put on from time to time, or they will soon go down. If you have a battery that will run 10 lights, and wish to run them until 10 o'clock P. M., you must have other batteries to reënforce it, or the lamps will diminish in candle power before the expiration of the time it is rated for. Then,

after turning off the lights, the batteries will lose about one-fifth of the charge remaining in them before being recharged.

There is a natural law working against the storage battery, and that is, that finely divided lead decomposes water. It is stated that when Sir William Thomson had his attention called to this fact he threw up the sponge. All metals are fuel. When oxidized they are ashes, and it takes energy to put them back again into a metallic form, when it is again fuel. Mr. Brush may say he has a secret compound. It is nothing more than a salt of lead. They use lead, and their battery is nothing more than a Faure battery, plain and simple. They say they cannot furnish these batteries for six months. There are shops in this city that can turn out 6,000 of their cells within three weeks. The parent Brush Company is a respectable and responsible organization, but the Brush-Swan Storage Company seems to be a corporation for shifting responsibilities from the Brush parent company.'

Mr. Edison here took up a paper and read some extracts from an article about the Brush-Swan Electric Light Company. Commenting on it, he said, among other things: 'I believe there is a society for the prevention of cruelty to animals, and another for the prevention of cruelty to children. Now, they ought to get up a society to prevent people making fools of themselves. The receiving of money for such articles as these [referring to the one he was reading] ought to be made an offence at law, for, if it is not a form of obtaining money by false pretences, I do not know what is.'

'Now, we will return to the storage battery once more, and compare its costs and results with those of the direct system. According to M. Tresca's recent experiments with a Faure battery at the Conservatoire des Arts et Metiers, Paris, under the most favorable conditions, it was found that it gave only 50 per cent. from the dynamo and 45 per cent. from the engine. This

battery, which ran 11 lamps for 11 hours, weighed 2,310 pounds. This gives 190 pounds of battery per 10 lamps per hour. If this battery is saleable at 35 cents per pound, the cost for battery for 10 lamps per hour is $66.50, or $6.65 for one lamp per hour. For 250 lights for one hour the cost of battery is, therefore, $1,662.50, and for six hours, $9,975. That is, a battery to operate 250 lamps for six hours costs $9,975.

Depreciation, 25 per cent..................	$2,493 75
Interest, 8 per cent........................	798 00
As the statement is 10 lamps per horse power for the storage cells, they develop 25 horse power; but as 50 per cent. of the energy developed by the engine is all that is returned by battery, 37.5 horse power was required during the 8 hours of charging. A total of 300 horse power is developed by the engine at 4 pounds of coal per horse power—a total of 1,200 pounds per day, or of 180 tons a year, counting 300 days, at $4.50 per ton....................................	810 00
Investment of $3,000 for dynamo with which to charge the cells, and 10 per cent. annual interest and depreciation................	300 00
Total annual expense *without* cost of dynamo and batteries..........................	$4,401 75

'There, you have the annual cost by the battery, for running 250 lights six hours per day for 300 days. You will observe that only interest and depreciation of plant and actual cost of fuel are charged. Let us now compare the same service by the direct

system, throwing in the cost of the dynamo, and see what result we shall obtain:

Cost of dynamo..........................	$3,000
Interest and depreciation 10 per cent........	300
To run this dynamo to supply lamps direct, will require 35 horse power, and, for six hours, a total of 210 horse power. Allowing, as in the other case, 4 pounds of coal per horse power, would give a consumption of 840 pounds of coal per day, and for 300 days, 252,000 pounds, or 126 tons per annum, at $4.50 per ton.........................	567
Total annual expense, $867, and, *including* cost of dynamo, it would still be but...........	$3,867

or $534.75 less than the single cost of doing the same service by the battery system. If we count the cost of dynamo and battery of the indirect system we have $12,975 for plant, as against our $3,000 by the direct system. Have I made the matter plain to you? These are the people who proclaim in flashy circulars that they can light cotton mills an hour or two a day by putting in a little dynamo to run eight hours, store up the electricity produced, and thus save the cost of an expensive plant to run the direct lights. The battery people will probably state that the cost of the battery given by me is excessive; that they will agree to sell them for much less, and will, probably, actually do so, as was done in England with the Lane-Fox lamp, which was sold in quantity to the subsidiary companies for 5 shillings, while they cost 12 shillings to manufacture.'

Mr. Edison then went into calculations for smaller plants, but, as his figures would only confirm what he has just given, the writer thinks he need not repeat them."

THE SWAN LAMP PATENTS.

Mr. Joseph Wilson Swan, of England, after whom the "Swan Lamp" is named, has only three patents in the United States, relating to incandescent electric lamps. The first, No. 233,445, was applied for April 12th, 1880, and granted October 19th, 1880; the second, No. 234,345, was applied for June 16th, 1880, and granted November 9th, 1880; the third, No. 260,335, was applied for April 17th, 1882, and granted June 27th, 1882. These are the only patents on the "Swan Lamp" in the United States.

Before stating what these patents cover, let us see what they do not cover. In that regard, Mr. Swan's own admissions are important. In his specification filed when he applied for his first patent (No. 233,445), he says: "My invention relates to that kind of electric lamp in which light is produced by the incandescence of a continuous conductor of carbon enclosed in an exhausted glass bulb, and provides means for increasing the durability of the said kind of lamp." Just what is meant by this statement prepared by Mr. Swan himself should be carefully noted. What does he mean?

First. Swan does not claim himself to have invented an "electric lamp," but merely to have invented "means for increasing the durability" of one. In other words, he claims only an improvement on an existing lamp.

Second. The "kind of lamp" which his invention "relates to," was one which he found in existence when he undertook to improve it; one, he says, "in which light is produced by the in-

candescence of a continuous conductor of carbon enclosed in an exhausted glass bulb." That is to say, Mr. Swan found such a lamp in existence, and he tried to improve it.

Third. This description of an electric lamp which Mr. Swan undertook to improve, is an exact description of the Edison incandescent lamp, on which a patent was allowed to Mr. Edison in the United States, December 19th, 1879, and issued to him (No. 223,898) January 27th, 1880, several months before Mr. Swan even filed his application for his first patent. This patent thus granted to Edison was for "an electric lamp for giving light by incandescence," by means of "carbon filaments" enclosed in a "receiver made entirely of glass from which the air is exhausted," which is exactly the lamp referred to and described by Mr. Swan, at a later date, in his patent.

Thus it appears that Mr. Swan himself disclaims to have invented an incandescent electric lamp, and that all he claims to cover by his patents (this is true of his second and third patents as well as his first) are merely minor points of mechanical detail, being merely alleged improvements in the durability of an incandescent lamp already in existence.

Let us now see just what these alleged inventions claimed by Mr. Swan amount to. His first patent (No. 233,445) has four claims, viz: first platinum caps connected to both the glass and the leading-in wires; second, the carbon loop or horseshoe formed from a straight strip of parchment paper bent into shape; third, the carbon made of parchment paper; and, fourth, coating the leading-in wires and caps with glass or enamel. His second patent (No. 234,345), contains two claims: first, parchmentizing thread prior to its carbonization, and, second, making enlarged ends therein by wrapping material therearound and cementing the wrapped material by parchmentization.

His third patent has four claims, all relating to attaching the carbon filament to the wires of the lamp, by producing a local deposit of carbon at the ends of the filament, and over the tubular ends of the wires which receive the filament. The effects of this deposit is also to enlarge the ends of the filament.

Are these alleged inventions, admitting that they are such, of any value? Let us consider them in order.

In Swan's first patent the first claim is for platinum caps uniting the glass and leading-in wires. Mr. Edison uses the platinum leading-in wires, but omits the cap. Mr. Swan claims that the use of the platinum cap is an improvement on Mr. Edison's method, because a better contact may be made between the platinum and the glass. The fact is, Edison early tried both ways and the result of his experiments was that the contact was just as good in one case as in the other, and that the omission of the platinum cap, which alone costs nearly as much as Edison's entire lamp, as now manufactured, was an important step towards economy. Besides that, if the small platinum leading-in wires will not make a reliable union with the glass, surely Swan's increase of the platinum surface will not remedy the defect. If there be any defect in such union in the one case, it will still exist even to a greater extent in the other.

The second claim in Mr. Swan's first patent is for a straight strip of paper bent into a loop or horseshoe. This was the form first used by Edison, long before the earliest date which Mr. Swan can maintain in this country, and Mr. Edison has continued to use this method of cutting up to the present time, his bamboo filaments being cut in straight strips and bent into loop form before carbonization. The claim in the Swan patent, however, is limited to the cutting of paper, and hence does not cover the methods employed with bamboo.

The third point in Swan's first patent, and the first point of his second patent, is parchmentization prior to carbonization. Edison tested this as early as 1878, and he soon after mentioned it in a caveat. He made a large number of lamps in this way, but considerations of cheapness and uniformity have caused him to adhere in the manufacture of lamps for sale to filaments cut from bamboo and carbonized without the additional step of parchmentization.

The fourth claim in Swan's first patent is coating the leading-in wires and caps with glass or enamel. Mr. Edison also used this device, but being able to make a perfect lamp without the expense of this additional step, it is not employed in the manufacture of the Edison lamps.

The remaining point in the second Swan patent, is making the enlarged ends by wrapping. This is neither so cheap, effective nor simple as the later plan invented by and now used by Mr. Edison, namely, simply striking out or cutting the carbon with its enlarged ends homogeneous with the body. By the latter there are no additional steps, while by the Swan plan there is an additional step, requiring tedious and delicate manipulation, adding to the cost.

The third Swan patent on the securing of the carbon filament to the wires by a local deposit of carbon, describes a process which is essentially the same as that covered by a patent granted to Mr. Edison, March 22d, 1881 (No. 239,151), over a year before Mr. Swan filed his U. S. application, or more than six months before Mr. Swan filed his application in England. Mr. Swan's patent covers only one of the specific results of Mr. Edison's process, and it is therefore tributary to the Edison patent. Mr. Edison also accomplished the specific result claimed by Mr. Swan, and could undoubtedly prevail in an interference if the matter were thought of sufficient importance to warrant the expense

For this particular portion of his lamp Mr. Edison now uses cheaper and better methods, which are fully covered by patents.

It thus appears that Mr. Swan's so-called improvements on parts of the incandescent lamp are, commercially speaking, of little value. Every point claimed by Swan is something which Mr. Edison has used, but which has been superseded by other inventions in the march towards simplification, which means the best result, and the best service for the least money.

Having thus shown what the alleged inventions in the three Swan patents amount to, let us see whether Mr. Swan has a good title even to what he claims.

Upon the second and third points in his first patent Swan is already in interference in the Patent Office with both Edison and Maxim. On such points, Swan being a foreigner, the earliest date of invention which under the law he will be permitted to prove, is either the date of filing his application in this country, viz: April 12th, 1880, or the date of his earliest foreign publication, namely, his English patent of July 20th, 1880. Both Edison and Maxim, in their preliminary statements, set up dates long anterior to Swan's earliest legal dates in this country, and there can be no doubt that one or the other will prevail against him and receive the valid patent on these points. As to his second patent, applied for June 16th, 1880, which is the earliest date of invention our law assigns to him, being a foreign inventor, as against a citizen inventor, Mr. Edison attacks him on the broad grounds of making enlarged ends by wrapping around the end of the carbons. This invention was not only made, but was publicly mentioned by Mr. Edison long before Mr. Swan's earliest date of June 16th, 1880. Indeed, it was even described in one of Mr. Edison's patents (Edison's Canadian Patent No. 11,520), filed before that date. There can be no doubt, therefore,

that Edison will prevail against Swan on this point. The same is also true of the points covered by the third patent. Thus, of the few things claimed by Swan in his three patents, it is certain he cannot hold two of them, and it is probable, for reasons which should not now be divulged, that he can not hold any. But even if he could hold them all, Mr. Edison would be entirely unaffected, because Mr. Swan's patents are simply for matters of detail, which Mr. Edison no longer uses. Swan covers nothing Edison uses, and what Swan uses Edison has left behind.

Thus it appears, with regard to the Swan patents—first, that they do not cover an electric lamp, and contain no broad or fundamental principles, but are matters of mere mechanical detail; second, with reference to a part of the alleged inventions embraced in the patents, Swan is in interference with two other inventors, and there is every reason to believe he will be defeated; and third, that the art of making an incandescent lamp has advanced so far since Swan's alleged inventions were made as to make them of little or no commercial value at the present day.

But it must be remembered that even if Mr. Swan's patents were for a lamp instead of for a few details of one, and even if those details were important, his patents would still amount to nothing unless he had also invented and patented a comprehensive system of using them. In this respect Mr. Swan has nothing. He has no patents whatever on any system or on any of the almost innumerable details needed in a lighting system, involving regulation, distribution, measurement, conductors, safety-catches, meters, chandeliers, brackets, drop-lights, etc.; nor do the Swan patents confer any right on him to use any such things, or even to make a lamp. The slightest use of what he alleges to be his inventions involves infringement of underlying patents granted to another. All these details of the necessary parts of a system of

incandescent lighting have been elaborated and patented by Mr. Edison. It is impossible to make or introduce an incandescent lamp without them.

In this connection, a concise statement should be made of Mr. Edison's patents, including his fundamental patents on an electric lamp, his patents on methods of manufacturing a lamp and mechanical details, together with his large number of patents on the important details of a system of incandescent lighting. The fundamental patents, which give Edison a monopoly of the incandescent lamp, are as follows, namely, No. 223,898, dated January 27th, 1880; No. 227,229, dated May 4th, 1880; and No. 230,255, dated July 20th, 1880. Besides these, Mr. Edison has 83 other patents already granted in this country on the lamp alone, and has applications for 75 more patents on the lamp alone now awaiting decision. In these patents, and especially in the first three above named, the following points are broadly covered to Mr. Edison:

1. An electric lamp having a continuous conductor (without regard to its material, resistance or mode of preparation) and an exhausted glass enclosing globe.

2. An electric lamp having a continuous carbon conductor (irrespective of its material, resistance or mode of preparation) and an exhausted glass enclosing globe.

3. A filament of carbon of high resistance secured to metallic conductors (*i. e.*, the leading-in wires).

4. The method of manufacture, *i. e.*, first, separately forming the enclosing globe and the support for the carbon, and then affixing the carbon upon the latter, uniting the globe and support, and then exhausting.

The broad principles covered in the above-named fundamental patents allowed to Mr. Edison are so exclusive that it is not too

much to say that neither Swan nor any one else has made or can make a successful incandescent lamp without infringing every one of the above patents.

But these patents allowed to Mr. Edison on his lamp are only a small portion of the patents allowed to him in connection with the use of the lamp. Up to the present time no less than 227 patents have been allowed Mr. Edison, in the United States alone, on his lamp and on the details connected with its manufacture and use, and he also has 179 additional applications for patents on the same subject now awaiting examination at the Patent Office. These patents cover such subjects as the lamp, regulators, dynamos, meters, motors, conductors, underground mains, junction boxes, sockets, chandeliers, brackets, and many other devices, altogether constituting a complete and perfect *system* of electric lighting.

The whole subject of the Swan patents in the United States may be summed up as follows:

1st. Mr. Edison is an original inventor of a new type or genus of lamp. Mr. Swan does not claim to be such an inventor, and claims only to have made improvements of detail in such a class or genus. Indeed, Swan disclaims the inventorship of the class or genus.

2d. This new type or genus of lamp is patented broadly to Mr. Edison.

3d. All that Mr. Swan claims are only some minor features of alleged improvements, but they cannot be considered as having been improvements even at the dates of Mr. Swan's patents, *all* of them having been used by Mr. Edison and superseded by simpler and more economical means long before Mr. Swan's patents were issued.

4th. Mr. Swan's title to some of the points or improvements he even does claim, is in litigation. If he prevails in the litigation, he cannot injure Mr. Edison, as Mr. Edison uses none of the points in controversy. Nor could Swan even then make and use a lamp, for he must infringe, in using his own alleged inventions, several prior fundamental patents previously issued to Edison.

5th. As to the points covered by the Swan patents which are not now in actual contest, Mr. Edison retains the right to establish priority of invention, and to obtain patents, if at any time these points should prove of sufficient commercial value to warrant his doing so.

No. 22.
APRIL 9, 1884.

TWENTY SECOND BULLETIN.

The Edison Electric Light Company

65 FIFTH AVENUE, NEW YORK.

April 9th, 1884.

(These bulletins, originally issued as a convenient way of answering the inquiries of distant agents, are now, in response to numerous requests, sent also to all stockholders, to give them information of the progress of the Company and of other matters of greater or less interest connected with electric lighting. Agents are particularly requested to communicate to the President whatever practical points of general interest may be developed by their experience in installing or operating our lights.)

CONTENTS.

FIRST DISTRICT, N. Y. CITY. THE PLANT ENLARGED. This plant is now in its nineteenth month of continuous running. We are at present lighting over 500 houses, wired for nearly 13,000 lamps, of which 11,272 are actually attached to the conductors, available at will. The demand for the light far exceeds the supply, and the station is now being enlarged by installing additional dynamos in the adjoining building, giving an increased capacity of about 3,000 lamps.

TESTIMONIAL. DAVOL MILLS, FALL RIVER. We have received the following testimonial from the Davol Mills:

"Office of the DAVOL MILLS,
FALL RIVER, Nov. 20th, 1883.

SPENCER BORDEN, ESQ., AGENT,
Boston, Mass.

DEAR SIR:—In regard to our electric light plant of 350 16-candle power lamps, installed by you in June, would say that the Edison system was adopted by us after a thorough and careful examination as to the merits of this and other systems, and our experience has thus far fully confirmed our previous opinions.

The results of tests for amount of power required to run the plant, are very satisfactory. Our "H" dynamo is run directly from our 30 x 72 engine, and a careful test by indicator made Sept. 6th, with 312 lamps running *fully up to candle power* of the lamps, gave us as amount of power used 34.2 H. P., an average of 9.12 per H. P.

The attendance bestowed upon the running of the plant by us, is about one hour in the morning, and two hours at evening by our master mechanic, and during the remainder of the day it is run by our engineer in charge of the main engine.

I would say that our basement weave room, requires light during the entire day almost without exception, say 60 or 70 lamps.

Our total loss of lamps by carelessness and burning out has thus far averaged about one lamp per day, which we naturally expect to increase. Our brushes and commutator are in excellent condition, and look as if they might last for years.

We are fully satisfied as to cost, quality and quantity of light.

Yours very truly,
ALBERT F. DOW, Agent."

TESTIMONIAL. ECONOMY OF THE EDISON LIGHT. By permission, we publish the following letter written to Mr. Henry Crofut, Danbury, Conn. by Messrs. John B. Stetson & Co., Philadelphia:

"PHILADELPHIA, Pa., Nov. 23d, 1883.

Mr. HENRY CROFUT, Danbury, Conn.,

DEAR SIR:—Your letter of inquiry dated Nov. 17th, was duly received on the 19th. The only experience we have of the Edison incandescent light is what we have had in our factory for the past two years. When placing the present plant, consisting of 80 H. P. engine and 2 K dynamos, we made a test on April 13th, 1883 and found the following: Lamps in circuit 500, for 5 hours; revolutions engine 173; of dynamos 900; initial pressure of steam 70 lbs.; coal consumed 1,680 lbs.; oil used 1 qt.; water 1,824 galls.; total cost reckoning for breakage of lamps, men's time, and interest on investment was $8.76; whereas, for 500 gas burners used 5 hours 12 M ft. would be consumed @ $1.90 per M = $22.80; so the electric was $14.04 cheaper, besides being more satisfactory as an illuminator.

Very truly yours,
JOHN B. STETSON & CO."

OUR LIGHT ENABLES A FACTORY TO RUN MORE HOURS. The light from the Edison plant installed in the cloth mill of the Broad Brook Co., Conn. is used in the finishing room, where the cloth receives its final inspection, and, if necessary, slight imperfections are repaired with the needle. Finding it impossible to get any arrangement of gas lights which would enable them to turn out

satisfactory work, the menders have always been obliged to stop work at dark. Since the Edison light has been introduced in the finishing room, the out put of the factory has been almost doubled, because the light can be used where gas or other artificial light could not. The agent told our representative that the Edison light would enable him to deliver enough ordered goods, which would otherwise have been countermanded, to clear the cost of the plant this season.

TESTIMONIAL. WORSTED MILL, MALDEN. The following letter has been received from Mr. John Cochrane, Jr.:

"MEDFORD, MASS., March 28th, 1884.

EDISON ELECTRIC CO.,
Boston.

GENTLEMEN: It gives me pleasure to inform you of the excellent working of electric lights you put up in my worsted mill in Malden. They have been in operation for more than two months and for the past month running all night. The cost of power attending the lighting seems to be practically nothing, as I am unable to detect any extra consumption of fuel. Ten dollars will, so far, cover all breakage of lamps. The general easy working of the plant and quality of light is fully up to my expectation and beyond your representations.

Yours truly,
JOHN COCHRANE, JR."

TESTIMONIAL. COLUMBIAN MILLS, SOUTHBRIDGE. We have received the following letter from the Columbian Mills:

"SOUTHBRIDGE, MASS., March 28th, 1884.

EDISON ELECTRIC LIGHT CO.,
Boston.

GENTS:—Your favor of 27th inst. received, asking about the working of our light. It has worked entirely satisfactory to us from the moment it started—which was about the first of January last—having had no trouble. Before putting in the electric light we used kerosene oil, consequently are dependent entirely on the electric light and have no reason to require other. We have

run them about 700 hours. As to the expense we are unable to say, not yet knowing the life of the lamps or machine—and cost of power we are unable to determine exactly because we have used both steam and water. The labor taking care of the machine is so little we can't estimate it.

Neither gas or oil could give so good satisfaction.

Yours truly,
COLUMBIAN MILLS."

PLANTS SOLD SINCE MAY 31ST, 1883. The 18th Bulletin contained a list of all Edison isolated plants then in operation in various parts of the world, 334 plants, aggregating 65,145 lamps. Of these, 180 plants, 39,519 lamps, were in the United States, and the remainder were in other parts of the world.

Since the 18th Bulletin, May 31st, 1883, we have sold the following permanent plants in the United States and Canada, making a total in this country, to date, of 307 plants, aggregating 50,173 lamps.

PLANTS SOLD SINCE MAY 31ST, 1883.

NAME OF OWNER.	ADDRESS.	LOCATION OF PLANT.	NUMBER OF LAMPS.
Anson Eldred Lumber & M'f'g Co	Fort Howard, Wis.	Saw Mill	60
Anson Eldred & Son	Stiles, Wis	Saw Mill	50
Albany Perforated Wrapping & Writing Paper Co	Albany, N. Y.	Paper Factory	25
Robert Allison	Port Carbon, Pa.	Iron Works	100
Amory Manf'g Co	Manchester, Mass	Cotton Mill	50*
Arnold Constable & Co.	New York City	For Storage Warehouse	50
Anchor Milling Co	St. Louis, Mo	Flour Mill	25
Arkansaw Oil Co	Texarkana, Kansas	Oil Works	100
American Wire Nail Co	Circleville, Ohio	Nail Factory	50
Simon Bache & Co	New York City	Store and Offices	200
Brooklyn Sugar Refinery	Brooklyn, N. Y.	Sugar Refinery	320*
Belcher Sugar Refinery	St. Louis, Mo	" "	300
Broad Brook Co	Broad Brook, Conn.	Cloth Mill	50
Baltimore Steam Packet Co	Baltimore, Md	For Docks	150
Chickering & Sons	Boston, Mass	Piano Show Room	174
Chicago Packing & Provision Co.	Chicago, Ills	Packing Houses	174
Chicago, Milwaukee & St. Paul R. R. Co	Milwaukee, Wis.	Iron Working Shops	400
Continental Worsted Mills	Philadelphia, Pa	Worsted Mill	300

PLANTS SOLD SINCE MAY 31ST, 1883.—Continued.

Name of Owner.	Address.	Location of Plant.	Number of Lamps.
Canadian Cotton Co.	Cornwall, Canada	Cotton Mill	900*
John Cochrane, Jr.	Malden, Mass	Worsted Mill	100
Central R. R. Co. of N. J.	Philadelphia, Pa.	Ferryboat "Fanwood"	60
" " " "	" "	" "Central"	60
" " " "	" "	" "Plainfield"	60
" " " "	" "	" "Communipaw"	60
Columbia College	New York City	For Library, etc	200
College of the City of New York	" " "	For Work Shop	25
Canada Sugar Refining Co.	Montreal, Ca.	Sugar Refinery	250
Canadian Pacific R. R. Co.	" "	S. S. "Algoma"	100
" " "	" "	" "Alberta"	100
" " "	" "	" "Arthabaska"	100
Conglomerate Mining Co.	Lac la Belle, Mich.	Mine	100
Columbian Mills	Southbridge, Mass.	Worsted Mills	100
Davol Mills	Fall River, Mass	Cotton Mill	350
Darlington, Runk & Co	Philadelphia, Pa.	Dry Goods	400
Enterprise Manf'g Co.	Augusta, Ga.	Cotton Mill	550
Exposition Cotton Mill	Atlanta, Ga.	" "	350
Eclipse Lubricating Oil Co.	Franklin, Pa.	Oil Works	25
Eden Musee American Co. (Ld.	New York City	Entertainment Hall	200
Flint Mills	Fall River, Mass.	Cotton Mill	650
Fulton Iron Works	Detroit, Mich.	Engine Shops	50
Friends School	Providence, R. I.	School	25
Frambach Paper Co.	Kaukauna, Wis.	Paper Mill	50
Max Fleischmann	Williamsburg, N. Y.	Distillery	25
G. H. Gilbert Manf'g Co.	Ware, Mass.	Woolen Mill	200
G. K. Goulding	Malden, Mass.	Cotton Waste Factory	25
Garner & Co.	Wappingers Falls, N. Y.	Cotton Mill	100
Goldrie & McCulloch	Galt, Ontario	Engine Shops	100
Glen Pulp Paper Co.	Hoosac Tunnel Mass	Paper Mill	25
Gorham Manf'g Co.	19th St. & B'way New York City	Store and Offices	288
Globe Democrat	St. Louis, Mo.	Newspaper Offices	200
William J. Hooper & Sons	Baltimore, Md	*The Herald* Offices and Rope Factory	300
H. J. Holbrook & Co.	Utica, N. Y.	Shoe Factory	200
Harrison, Havemeyer & Co	Philadelphia, Pa.	Sugar Refinery	150*
"Huylers'"	863 Broadway, N. Y.	Candy Store	100
Harry Hill	New York City	Theatre	150
Halifax Sugar Refinery	Halifax, N. S	Sugar Refinery	200
L. F. Hepburn & Co.	Stratford, N. Y.	Piano Sounding Board Factory	50
O. Hammond, Jr.	Baltimore, Md.	Packing House	50
C. L. Hawes	Dayton, Ohio.	Straw Board Mill	100
Ill. Central R. R. Co.	Jeffersonville, Ind.	Transfer Boat	50
Jenks Manufacturing Co.	Pawtucket, R. I.	Machine Shops	100
John P. King Mill Co.	Augusta, Ga.	Cotton Mill	765

PLANTS SOLD SINCE MAY 31ST, 1883.—Continued.

Name of Owner.	Address.	Location of Plant.	Number of Lamps.
Kiralfy Brothers	New York City	For "Excelsior"	50
Lape & Brother	Cincinnati, Ohio	Flouring Mill	50
J. W. Livezey & Co.	Newport, Ky.	Saw Mill	50
Larrabee & Co.	Troy, N. Y.	Cracker Factory	180
Mandel Brothers	Chicago, Ills.	Dry Goods	640
Montaup Mill	Fall River, Mass	Cotton Mill	105
Midvale Steel Works	Philadelphia, Pa.	Steel Works	100
C. L. McArthur & Son	Troy, N. Y	*Northern Budget* and *Troy Telegram*	60
Marstock M'f'g Co.	Danville, Va.	Cotton Mill	150
Merrick Thread Co.	Holyoke, Mass.	Thread Works	300
D. McCarthy & Son	Syracuse, N. Y.	Dry Goods Store	130
Madison Woolen Mill	Madison, Ind	Woolen Mill	100
Milone Sewing Machine Co	Chillicothe, Ohio	Machine Shop	100
Eugene Munson	Williamsport, Pa.	Planing Mill	50
Michigan School for the Blind	Lansing, Mich.	Institute Building	300
Miller Manual Labor School	Batesville, Va.	School	150*
Mitchell, Vance & Co.	N. Y. City	Offices	25
New Bedford Cordage Co	New Bedford, Mass.	Rope Factory	160
Robert P. Nevin	Pittsburg, Pa	*Pittsburg Times* Offices	25
Northern Pacific R. R. Co.	Portland, Oregon	S. S. "Kalama"	60
National Manf'g Co.	Nashville, Tenn.	Cotton Mill	125
N. Y. L. E. & W. R. R. Co.	Buffalo, N. Y	Grain Elevator	150
Norwich & New York Transportation Co.	New London, Conn.	Str. "City of Worcester"	217*
Naumkeag Mills	Salem, Mass	Cotton Mill	500
New Orleans Refrigerator Co	New Orleans, La.	Cold Storage	50
John T. Noye M'f'g Co.	Buffalo, N. Y.	Machine Shops	60
M. & W. H. Nixon	Philadelphia, Pa.	Paper Mill	50
Newton & Co.	Albany, N. Y.	Fire Brick Factory	50
Norton & Co.	Lockport, Ills.	Flour Mill	50
Oceanic Steamship Co	San Francisco, Cal.	S. S. "Kinau"	100
Oregon R. R. & Nav. Co.	Portland, Oregon.	" "Alaskian"	100
" " "	" "	" "Olympian"	300
Ohio Paper Co.	Niles, Mich.	Paper Mill	50
Ohio Edison Installation Co.	Cincinnati, Ohio	Offices	60
Philadelphia Water Works	Philadelphia, Pa	Belmont Pumping Station	60
Press Company	Albany, N. Y.	*Daily Press and Knickerbocker*	60
Park & Tilford	New York City	Store and Offices	260
Plankinton House	Milwaukee, Wis.	Dining Room, etc	200
Pakachoag Mills	Worcester, Mass.	Worsted Mill	160
Pettibone Paper Co.	Niagara Falls, N. Y.	Paper Factory	25
Pfeffer & Son	Carlisle, Pa.	*The Sentinel* Offices and Composing Rooms	81
Queens Co. Oil Works	Blissville, L. I.	Oil Refinery	100
Russel, Morgan & Co.	Cincinnati, Ohio.	Printers	200

PLANTS SOLD SINCE MAY 31ST, 1883. Continued.

Name of Owner	Address.	Location of Plant.	Number of Lamps.
Riverside Cotton Mills	Danville, Va.	Cotton Mill	150
Rock Manuf'g Co.	Rockville, Ct.	Woolen Mill	50
E. Sanderson & Co.	Milwaukee, Wis.	Flour Mill	60
State Institute for the Education of the Deaf and Dumb	Jacksonville, Ills.	School, etc.	60
Sanderson Bros. Steel Co.	Syracuse, N. Y.	Steel Works	100
Jacob C. Shafer	Baltimore, Md.	Pork Packing Houses	50
Sechler & Co.	Cincinnati, Ohio.	Carriage Building Shops	25
Southern Car Works	Knoxville, Tenn.	Machine Shops	50
Sweet Manufacturing Co.	Syracuse, N. Y.	" "	25
Stern Brothers	14 West 23d St., N. Y.	Dry Goods Store	75
Shipper's Upper Columbia River Transportation Co.	Evansville, Ind.	Str. "Benton McMiller".	25
Schoellkopf & Matthews	Niagara Falls, N. Y.	Flour Mill	100
Susquehanna Water Power Paper Company	Conowingo, Md.	Paper Factory	50
William Sellers & Co.	Millbourne, Pa.	Flour Mill	50
Wm. Sooy Smith & Son	Havre de Grace, Md.	For Lighting Caisson	25
St. Lawrence Sugar Refining Co.	Montreal, Ca.	Sugar Refinery	200
Thornton & Chester	Buffalo, N. Y.	Flour Mill	60
Taylor, Wolfenden & Co.	Cardington, Pa.	Woolen Mill	50
Turkey Red Dyeing Co.	Bellefonte, R. I.	Dye Houses	50
Troy Times	Troy, N. Y.	Newspaper Offices	50
U. S. Government	Washington, D. C.	S. S. "Trenton"	150
" "	" "	Boston Post Office	100
" "	" "	Gov. Printing Office	525
Viaduct Manf'g Co.	Baltimore, Md.	Electrical Works	120
Western Nail Co.*	Belleville, Ills.	Nail Factory	300
Wolfenden, Shore & Co.	Cardington, Pa.	Woolen Mill	100
Worcester Corset Co.	Worcester, Mass.	Corset Factory	200
Ypsilanti Paper Co.	Ypsilanti, Mich.	Paper Mill	60

* The sales marked thus * are increases of plants already installed

FIRST PRIZES FOR THE EDISON LIGHT AT THE LOUISVILLE EXPOSITION. Four first prizes were awarded the Edison Company by the jury appointed by the Commissioners of the Southern Exposition recently held at Louisville. These prizes were for (1) the best Incandescent Light System; (2) the best Dynamo for Incandescent Lights; (3) the best Electric Lamp for Incandescent Light; and (4) the best Incandescent Light. The jury consisted of Mr. Benjamin Rankin, Chairman, Superintendent of the Louisville Gas Company; H. W. Eaton, Ph. D., Professor of Physics and

Chemistry at the Louisville Male High School; Mr. W. W. Weaver, Mechanical Engineer, connected with the Babcock & Wilcox Boiler Co., Chicago, Ill.; Mr. Charles Smith, Electrician and Superintendent of the Western Union Telegraph Co., at Louisville; and J. A. Tanner, M. D., Lecturer and Scientist, of Polytechnic Society of Kentucky, Louisville.

The following extract is from the Report of the Jury, dated November 9th, 1883:

"The tests of the Edison system are most satisfactory as to the efficiency of the various appliances, the steadiness of the light produced and the general results. It is a matter worthy of notice that during the 100 days of the Exposition with over 4,000 Edison lights burning, there was not at any time a suspension of light from failure of the appliances of the Edison Electric Lighting Company."

The average life of our lamps for the whole period of the Exposition was 1,800 hours.

TESTIMONIAL. SYRACUSE, N. Y. We have received the following letter from Messrs. D. McCarthy & Co.:

"SYRACUSE, N. Y., Jan. 16th, 1884.

EDISON ELECTRIC LIGHT CO.

GENTLEMEN:—In reply to your request for a statement of our opinion regarding your system of lighting, which we have had in use in our store about four months.

We find it all and *even better* than you represented. We are perfectly satisfied. Heretofore we tried the arc system but found that it faded some of the fine shades of goods, and was unpleasant to the eyes, besides being very unreliable. Our Edison light is very soft without the disagreeable noise of the arc light. We believe all shades of colors can be easily distinguished by its use. It is also absolutely safe, a great consideration. All our help are well pleased with it. At the book-keepers' desks there are argand gas burners which are used when the current is not turned on. They all say the Edison light is the best they ever used for writing, and that when they return to gas they can scarcely see. We are obtaining from 20 per cent. to 28 per cent. more lights from the machine than you sold it for. We are running every night from 175 to 193 lights with a 150 light dynamo. This we consider a wonderful thing, for most machines run short of the guarantee. At first we feared it would burn the armature, but now consider it all right. We have over 200 lights placed, as we expect to increase our capacity by placing another dynamo

before long. The light seems to be fully up to required candle power, and the life of the lamps will, I believe, exceed your guarantee.

We put in new boilers, engine, etc., expressly for this plant. As to expense compared with gas at $2. per 1000, we find that taking interest on investment, depreciation and all running expenses, it costs less than half our former gas bill for the same time. We are obtaining more than five times as much light, which *is in every way preferable.* The light is used in elevator, sewing-rooms and on table in private office. In all places it has worked to perfection. We heartily recommend it.

Wishing you success,

D. McCarthy & Co."

TESTIMONIAL. COST OF THE EDISON LIGHT. Messrs. Clark & Keen, manufacturers of cloakings and suitings, Philadelphia, have supplied us with the following statement in regard to the cost of operating the Edison light in their establishment:

"Running Time:—	
161 nights of 12 hours,	1,922 hours.
40 days of 4 "	160 "
Total,	2082 "
Number of Lamps Run:—	
Average,	130
Number of lamps renewed,	135
Cost of Running:—	
Fuel, wear and tear, &c., $2 per night	$322.00
Lamps renewed	135.00
Oil and supplies	56.00
Wages of attendant, 32 weeks @ $10	320.00
Interest on plant @ 6%	124.90
Total,	$957.90

Average cost per day and night $5.33."

To light by gas for the same period of time, using a six-foot burner, formerly used, in place of each Edison 16-candle power lamp, would have cost as follows:

130 six ft. jets x 2,082 hours = 1,623,960 feet of gas @ $1.90	$3,083.70
Cost of Edison light,	957.90
Saving,	$2,125.83"

Messrs. Clark & Keen have also forwarded the following letter to us:

"Office of Clark & Keen, 1,720 North 2d St.,
Philadelphia, Pa., Dec. 17th, 1883.

Edison Co. for Isolated Lighting,

Gentlemen:—We cheerfully certify to the following statement:

1st. That since January 4th, 1883, until date, our 250 lamp dynamo machine has run without repairs or renewals of brushes.

2d. That the actual running time of same has been 2,767 hours.

3d. That in that time 267 lamps were broken;

And, that we consider our plant as valuable as any other machine we have.

We remain, yours, &c.,

Clark & Keen."

That means that the average life of our lamps has been 2,590 hours.

EDISON DYNAMOS FOR TELEGRAPH CIRCUITS. We have sold to the Philadelphia Local Telegraph Company two dynamos to supply current for the gold and stock reporting telegraph circuits of that company. We are informed by the company that the dynamos are giving entire satisfaction.

FOUR THEATRE PLANTS ABROAD. La Scala, Milan, is lighted with 2,600 Edison lamps from the Edison central station in that city. There are four main circuits, one of 946 lamps on the stage, another of 372 lamps in the dressing rooms, stage passages, etc., a third of 470 lamps in the orchestra, passages, corridors, boxes etc., and the fourth, 812 lamps, to light the entrances, foyer and café. On grand occasions the number of lamps on service can be increased by about 280 lamps.

The Manzoni Theatre, Milan, is also lighted from the Edison central station.

The Boehmisches National Theatre, Prague, is lighted by an Edison isolated plant of 1,300 lamps.

A certificate is published signed by the Burgomaster, Brunn, stating that the Edison installation in the Municipal Theatre in that city, "works to the general satisfaction of all concerned and that it has never given any cause whatever of complaint."

TESTIMONIAL FROM BALTIMORE. We have received the following letter from Messrs. William J. Hooper & Son, who use the Edison light in their twine and net factory, as well as in the offices and composing rooms of the Baltimore *Herald:*

"BALTIMORE TWINE & NET CO.,
BALTIMORE, MD., March 22d, 1884.

THE EDISON COMPANY FOR ISOLATED LIGHTING,
New York.

GENTLEMEN:—In answer to your inquiry to-day as to how we like your light and the cost as compared with that of gas we have to say that we have been running the light about six months, and do not hesitate to say that it costs about the same as though gas were furnished at 60 cents per 1,000. We are very much pleased with it and see no reason to regret the investment we have made.

In making the above estimate we have reckoned the entire cost; the cost of power, depreciation of plant and interest on the investment.

Yours respectfully,
WILLIAM J. HOOPER & SON."

THE BROCKTON COMPANY. MANAGER'S CIRCULAR. The following circular issued by the manager of the Edison Electric Illuminating Company of Brockton soon after starting and before people had become familiar with the light, is of interest:

"BROCKTON, MASS., November 14th, 1883.

TO OUR PATRONS:

We desire in the interest of economy to our customers, to call attention to several points which the consumers of the incandescent electric light are very naturally apt to overlook, and which bear directly upon the cost of their illumination.

1. The brilliancy of the arc light in cities has established an impression which it is now difficult to correct, that any electric lamp ought necessarily to develope an illumination of high intensity, and that an assurance that the Edison light shall cost no more than gas means that, for the money heretofore expended for a limited amount of gas-light, this company proposes to furnish a practically unlimited light by electricity. That this idea is not confined to Brockton will clearly appear by a quotation from an article printed in the New York *Post* of October 17, relative to the Edison system which has been in successful operation there since September 4, 1882.

"The chief and practically only complaint, according to Mr. Chinnock, the superintendent of the district, is that people burn the light recklessly, and are then suprised that their bills are higher than gas bills. 'The public,' said Mr. Chinnock, 'do not seem to believe that our meters are as accurate as gas meters. As a fact they are a good deal more so. People imagine that it does not cost us anything to give them the light; all that we have to do is to set our engines going, and whether they use more light or less light makes no difference to us. Some time ago we put electric lights into the office of an insurance company with the understanding that the light would cost no more than gas. The president or agent had twice as many electric lights put in as there had been gas lights, and at the end of the first month his bill, to his great astonishment, was double that of his former bills. He came to me to complain. I asked him what he had understood by our saying we could give him as much light for the same money as he had been getting from gas. '"Why,"' said he, '"I thought we were to have all the light we wanted."' 'I asked him if he had thought that he would be able to keep all his lamps going night and day straight along through the month.' '"Certainly,"' he replied. 'That is a sample of the understanding some people have of the electric light."' * * *

2. An impression also prevails that as an electric lamp can be made to yield a light greatly in excess of the power of any gas jet, a few Edison lamps should suffice to take the place of at least twice as many gas burners. We can furnish lamps of five degrees of power: 10, 16, 32, 50 and 100-candles, but our standard lamp here is the one of lowest brilliancy, 10 candles, which gives a light equal in illuminating efficiency to that of a good average burner consuming five feet of Brockton gas an hour. * * *

3. The running expense of the light can readily be computed by each customer from day to day. The policy of the company is to supply our light at the rate of gas at $2.00 per 1,000 feet. This is exactly what we are now doing, furnishing a 10-candle lamp at 1 cent per hour, which would be the cost of a 5-foot burner, and a 16-candle lamp, at 1.6 cents, which is the price of two 4-foot burners, or one argand at the same price per thousand.

4. We also call attention to the importance in making permanent electric light installations, and especially in wiring new buildings, of seeking competent advice as to the distribution of the light and the number of lamps.

* * * The facility with which the Edison lamp may be placed in any position and at any angle, often greatly assists in securing peculiar and striking effects without any excessive expenditure of light. In general we advise the placing of a good number of small lamps. This does not materially increase the first expense of wiring, and varying degrees of brilliancy may be secured by shutting off individual lamps, while a general diffusion is maintained.

5. Though permanent wiring between floors of buildings already occupied and fitted with gas and water pipes must of necessity be expensive, and the adaption of old gas fixtures to electric uses requires the utmost care and an outlay of time which must be determined by experience, yet work of this kind is by far the most satisfactory and productive of least future annoyance. Very neat and desirable work can now be done by the use of small ornamental mouldings covering cables of carefully protected wires on the ceiling of stores, offices, and even residences. The list of elaborate gold bronze and polished brass electroliers is now being supplemented by a variety of inexpensive and graceful fixtures adapted to all but the most ornamental style of work. No one need hesitate, therefore, on the score of first cost until he has thoroughly inquired into the expense of the most recent improvements, which are in the direction of good taste as well as of true economy. * * *

Yours very respectfully,

W. J. Jenks, Manager."

PROGRESS OF THE EDISON LIGHT IN GERMANY. We take the following extracts from the London *Electrician*, Feb. 16th:

"The German Edison Company have been hard at work during the past year, and we think it may interest our readers to have a brief *resumé* of what they have done. In Berlin, the headquarters of the company, a small central station has been fitted up for lighting the Union and Ressource Clubs. Each of these is lighted by some three hundred Edison lamps. From this station wires will shortly be laid to the Berlin Aquarium, which is to be lighted on the Edison system. Sixty lights have been put into the Café Lehman, and the same number into the Café Siechen. The warehouse of Messrs. Spindler, Dietrich and Busse, has also been lighted, one hundred lamps being used. During last summer a Sanitary Exhibition was held in Berlin, and one of its features was the Edison installation. The company lighted the Edison Pavilion, Café Baur, Military Kitchen, the Dining Pavilion, and also had lamps in various parts of the grounds. Over the dome of the Edison Pavilion the name Edison was exhibited in large letters formed of lamps. A commutator was so arranged in the machine room that one letter after the other could be thrown into circuit in rapid succession, the dynamo being only loaded with two letters at a time. The porter at the door had epaulets formed of incandescent lamps, as well

as one in his cap. These were connected to copper plates, in his heels, similar plates were let into the floor, and when the man connected his heel plates with these by standing on them, the lamps became incandescent, much to the astonishment of the visitors to the exhibition, who could not make out where the current came from. The company have wired several large buildings preparatory to introducing their system. Two of these are large cafés and others private houses. They have also wired their offices in the Leipziger Strasse. These they hope to light up when their central station is ready. They have lighted up the following sugar factories in Germany, viz:—Güstrow (two, 120-light dynamos), Neustadt, Silesia (one, 150-light dynamo), Ahrensbeck (one, 150-light dynamo), Gastrose (one, 120-light dynamo), Twilpstedt (one, 120-light dynamo), Papenteich (one, 120-light dynamo), Rositz (one, 250-light dynamo). The machines in these factories are kept running from 12 to 17 and 18 hours per day with their full load of lamps. The woolen factory of Herr Nicoli at Calbe has been fitted with 120 lights, the saw mill of Herr Crotogino at Rostock with 70 lights, the factory of Herr Hoffman at Neugersdorf with 25 lights, and the porcelain factory at Wallefangen with 30 lights. The company also have in hand a central station at Berlin, the fitting of the steamship "Werra" for the North German Lloyd's with 300 lamps; the fitting of a Chinese man-of-war now completing at Stettin with 300 lamps; this being the second man-of-war for the same Goverment fitted in a year; an installation of 100 lights in the powder factory at Spandau for the Prussian Government; an installation of 60 lights in a copper-rolling mill at Neustadt; an installation of 40 lights in a spinning mill at Braunsweig, and an installation of 60 lights in a mine near Hamur."

TESTIMONIAL FROM WESTERN NAIL CO., BELLEVILLE. The following letter has been received by the Western Edison Light Company:

"Belleville, Ill., Feb. 20th, 1884.

Western Edison Light Company,

Chicago, Ill.

Gentlemen:—Replying to yours of February 18th, your system of electric light is giving us very satisfactory results.

We have now in use 220 lamps, eight-candle power each, one lamp applied to each engine, lathe, grind-stone, and nail machine, furnishing ample light for the purposes required. It is very difficult for us to arrive at the cost per hour or day, for the reason that we draw our supply of steam used in running the dynamo from our regular battery of boilers supplying our factory engine. The entire appliances connected with the engine and dynamo, wires and lamps, are simple and easily operated.

For the purposes to which we apply the light we regard it as far superior to any other system of light we have used. We regard the system of applying the light by the use of the small glass globes as far preferable to the arc light system.

Yours truly,
WESTERN NAIL COMPANY,
W. H. POWELL, President."

TESTIMONIAL FROM YORK MANUFACTURING CO. We have received the following letter from the York Manufacturing Co., Saco, Maine, relating to the Edison plant in use at their mills:

"Office of YORK MANUFACTURING CO.,
SACO, ME., Nov. 15th, 1883.

EDISON CO. FOR ISOLATED LIGHTING.

GENTLEMEN: In regard to the economy of your electric light in our mills, we have found, on trial, that its cost is less than oil-gas at $1.00 per 1000 ft. In our estimated cost, a fair interest on plant and allowance for depreciation were included. Of course it is needless to speak of its advantages over gas in steadiness and absence of heat or vitiated air.

Very truly yours,
FRANKLIN NOURSE, Agent."

TESTIMONIAL. PHILADELPHIA. We have received the following letter from Messrs. Wolfenden, Shore & Co.:

"PHILADELPHIA, February 12th, 1884.

EDISON CO. FOR ISOLATED LIGHTING,

GENTLEMEN:—It gives us pleasure to say that both of the electric plants you have supplied to our mill have given us very good satisfaction in every way.

WOLFENDEN, SHORE & CO."

ANNUAL MEETING OF THE EDISON ELECTRIC ILLUMINATING COMPANY OF NEW YORK CITY. DIRECTORS' REPORT. ELECTION OF OFFICERS. The third annual meeting of the stockholders of this Company was held at No. 65 Fifth Avenue, December 11th, 1883. The following are the officers and directors for the ensuing year: President, (election postponed);

Vice President, S. B. Eaton; Treasurer, and Secretary *pro tem.*, F. S. Hastings; Directors: Thomas A. Edison, S. B. Eaton, J. F. de Navarro, Charles H. Coster, J. Hood Wright, G. P. Lowrey, Henry Villard, Erastus Wiman, C. T. Christensen, Spencer Trask, Francis R. Upton, F. S. Hastings, and Eugene Crowell. C. E. Chinnock, is continued as Superintendent of the First District.

The following is the Report of the Board of Directors submitted at the stockholders meeting:

"*To the Stockholders of the Edison Electric Illuminating Company of New York City:—*

Your Board of Directors desire to express their congratulations upon the continued success of the installation in the First District. Everybody likes the light, the demand for it far exceeds the supply, the station is already taxed to its fullest capacity without being able to take all the customers that apply, and the monthly receipts are in excess of the expenses. Thus the Pearl Street Station, originally started September 4th, 1882, and now in its sixteenth month of continuous operation, has demonstrated the practicability of the Edison system of central station lighting.

It may be of interest to repeat some of the details of the installation in the First District, recited in the last annual report. Our company, as will be remembered, is the owner of two adjoining buildings, purchased for the central station when the business was started; but only one of them, No. 257 Pearl street, has thus far been supplied with electric apparatus. The plant in that building consists of six steam dynamos, the accompanying boilers, and the various appliances for regulating, controlling and measuring the electric current. The engines attached to the dynamos have each a normal capacity of 125 horse-power, and a maximum of 200 horse-power, while each dynamo is capable of furnishing current for 1,000, and possibly 1,200, lamps. The steam dynamos weigh 30 tons each, making the aggregate weight 180 tons. The total network of underground conductors is 95,000 feet in length, which includes both the mains and feeders.

We are at present lighting in the First District about 500 houses, wired for about 13,000 lamps, of which 10,297 are in actual use, that is to say, attached to the conductors, available at the will of the customer. From the start, the number of customers has steadily increased month by month, as more fully appears by the following statement showing the number of customers and lamps at the beginning of each month since the station was first started:—

DATE.	NUMBER OF CONSUMERS.	LAMPS IN USE.	LAMPS WIRED FOR.
October 1st, 1882	59 customers.	1,284	1,626
November 1st, 1882	94 "	1,704	2,468
December 1st, 1882	203 "	3,144	4,838
January 1st, 1883	231 "	3,477	5,328
February 1st, 1883	302 "	4,131	6,161
March 1st, 1883	324 "	4,331	6,596
April 1st, 1883	361 "	4,884	7,871
May 1st, 1883	386 "	5,574	8,581
June 1st, 1883	410 "	6,466	10,268
July 1st, 1883	436* "	7,429	10,350
August 1st, 1883	443* "	7,946	10,920
September 1st, 1883	455 "	8,218	11,192
October 1st, 1883	472 "	8,573	11,555
November 1st, 1883	508 "	10,164	12,732
December 1st, 1883	513 "	10,297	12,925

* The reason for the difference between these figures and those in the 17th Bulletin is that complete reports had not then been received.

The Edison meters furnish the data, in every case, from which customers bills are made out. Each has a meter in his own premises, and his bill is made out and payment required upon what the meter shows. This inflexible rule has resulted in fixing close attention upon the meter, and has caused its accuracy and reliability to be subjected to severe tests. To accurately measure the electric current by means of a meter, and to do so with sufficient exactness to make out a bill the payment of which was to be insisted upon, at first seemed to many of our customers an impossibility. They accordingly resorted to various devices for the purpose of themselves testing the accuracy of the measurement. The most noteworthy of these, and one especially worthy of mention for the reason that it affords a simple and effective check against an incorrect bill, was to keep a record of the hours each lamp was in use, and, by multiplying this num-

ber of lamp hours by the given cost of a lamp per hour, to determine what the amount of the bill ought to be. Our charge for light in the First District is at the rate of 1 1-5 cents per lamp, per hour, consequently the products obtained by multiplying this price into the number of lamp hours shows what the consumer's bill for the light ought to be, and thus affords a complete check upon the accuracy of the meter measurements. There have been many cases during the year where, in order to satisfy customers that the meters were reliable, we have taken them out at the end of a given time during which the customer has kept an account of his lamp hours, and have presented bills made out on what the meters showed, in order that the customer might check the amount of the bill by the simple rule mentioned above. In all of these cases the accuracy of the meter has been maintained, and the confidence of the public has steadily increased, so that, at the present time, it can be safely said that the Edison meter, originally considered by some to be possibly the only doubtful part of the Edison system of central station lighting, is now generally admitted to be both scientifically and practically entirely exact and reliable.

But doubtless the best possible test of the accuracy of the meter is whether our customers pay their bills. They all know that their bills are made out on what the meters show, hence if they pay regularly, without complaint, it is good evidence that they are satisfied with the accuracy of the meter. The books of the company show that such is the case, and that the customers pay their bills regularly and without objection. If everybody paid his bill at sight upon presentation, the monthly bills rendered and the monthly receipts would agree, and although some customers are derelict and let their bills lay over unpaid until another month, there is still but a slight difference between the aggregate bills and the payments. To illustrate this the following statement has been prepared, covering the last six months, showing the aggregate amount of bills rendered to customers and the actual cash payments thereon:

MONTH.	BILLS RENDERED.	AMOUNT COLLECTED.
June, 1883	$5,204 14	$4,391 28
July, 1883	4,530 89	5,553 10
August, 1883	4,609 45	5,179 17
September, 1883	5,062 30	4,801 49
October, 1883	7,071 89	5,725 68
November, 1883	10,084 40	9,102 45
Total	$36,563 63	$34,753 17

In explanation of the above statement mention should be made of the fact hat the "Bills Rendered" in any one month, in October for instance, are less than the amount of light sold in that month. If all the meters were changed on the same day in each month, and, more especially, if they were all changed on the last day of the month, the bills being all rendered on that day, the aggregate of these bills would correspond with the actual sale of light for that month. But such is not the case. In order to enable one employee to take charge of all the meters, the total number of customers is divided into as many groups as there are working days in a month, and to each of these groups one day in a month is allotted. In this way a single employee can attend to all the meters, although he changes but a portion of them each day. If the consumption of light was about the same every month, this would make no difference as regards the "Bills Rendered," but inasmuch as the consumption varies greatly at certain times of the year, as in October, for instance, where there was a large increase over September, and more than double the amount of light sold than in August, the gross monthly sales necessarily differ from the bills presented. The actual amount of light sold in October was $10,293.98, and in November $10,631.88; but, owing to this method of changing meters daily, and to the further fact that the larger part of the increase in October occurred in the latter part of the month, more than half of the October sales appear in the November bills, and likewise at least one-half of the November sales will appear in the December bills.

We are now refusing to take more customers in the First District. All the lamps the station can safely supply are connected, and, although new applications for the light are often received, they have to be rejected. Some of the applicants thus rejected have left written applications for the light, with the understanding that they are to be supplied in turn as fast as there is any current to spare; and the number of these applicants now awaiting their turn, is 120. The underground conductors were proportioned to distribute the maximum current to be generated by the station when both buildings were fully equipped. But thus far only one-half of its ultimate equipment, one building, has been installed. The fact that the supply of current is now exhausted by profitable consumption and that new customers are being refused, together with the other highly important fact that the expense of running the station when enlarged will bear but a small proportion to the increased receipts, compels an early consideration of the question of increasing the current-supplying capacity. Mr. Edison is now experimenting to develop an increased capacity in the present dynamos, and his success will probably determine whether the desired increase of capacity in the station, required to provide for all possible customers, can be attained by mechanical changes in the present dynamos, or whether new and additional plant must be installed in the other building belonging to us, adjoining the present central station.

No power has yet been sold. Small motors are now being perfected. No large motors have yet been made, and even if they were completed, they could not be put into use until the capacity of the station is increased.

The light has now been in use in the First District for more than fifteen months, and sufficient experience has been gained to justify a correct opinion as to its merits. We have made especial efforts to ascertain what the opinion of our customers is, and, both through our employees and through others who are unknown to the consumers, we have tried to ascertain how the light is liked. Everybody likes it. A large portion of our customers go so far as to say that rather than part with it and go back to gas they would pay us an increased price, should we ever demand it; and some go so far as to state that, no matter what the light might cost, they would not give it up. A reasonable conclusion derived from the experience of the past year is not only that our light is uniformly liked and preferred to gas, but that even if the present price of gas were largely reduced, it would not be necessary for us to make a corresponding reduction in order to retain our customers. We believe that at the present fair and satisfactory price we can retain our present customers, and can secure in the future all the additional new ones we may be able to supply from an enlarged station, even though the present price of gas should be largely reduced.

The history of the great achievement which this scientific and commercial success implies, it is gratifying to recall. In 1879 many of the first scientific men of Great Britain unanimously declared their disbelief, before a select committee of the British House of Commons, in the possibility of any subdivision of the electric light. At that very time Mr. Edison, who had already accomplished this subdivision in a way which he believed capable of economical application, was engaged in his laboratory upon the great and complex task which he had set for himself. That task was to devise and put in successful operation, commercially, a system by which electrical currents could be generated and distributed from a central place to all the buildings in a town or other given area, this current to be turned by the householder at will, without danger or inconvenience, into a light healthful and agreeable to the eye, in quantity suited to domestic habits and necessities, and for a price which the consumer would be able and willing to pay, and which would return a satisfactory profit to the investor. This undertaking, in all its conditions, demonstrating both the possibility and the economy of subdividing the electric light, has been accomplished, and our first central station in this city is now regularly lighting its district at a profit which will afford a reasonable return upon the large investment required for this original and somewhat experimental station, as well as demonstrate that adequate dividends can be permanently maintained and relied upon in other districts hereafter occupied. By the experience already gained, the outlay for future installations of a similar character will be greatly reduced, and the profits proportionally increased.

In the last annual report reference was made to the rules adopted by the Board of Underwriters for the wiring of buildings for electric lighting. These rules have been carefully complied with, and the safety of our light as regards not only fire, but also danger to the person, has, we believe, been firmly estab-

lished to the entire satisfaction of the insurance officials. The intelligent and reasonable manner in which the Committee of the Board of Underwriters and their representatives having this especial matter in hand have discharged their duties and used the vast power entrusted to them, is entitled to the grateful acknowledgment of this company. A rigid compliance with their rules has been insisted upon, but as the regulations themselves were both fair and practicable, we have succeeded in satisfying the fullest requirements. No trouble has been experienced, except in the case of the earliest installations made at the very outset of the business, and then of so little moment as not to require attention. Thus the Edison system has sustained its reputation as the safest artificial illumination known.

The installation of additional central stations, in the upper part of the city, has been considered by your board on several occasions during the year. Two different propositions for furnishing capital to make uptown installations have been communicated to us, but the judgment of your board was that neither of them was favorable enough to be adopted. Our policy has been to postpone the question of installing other central stations until the one now running shall have been in operation long enough to completely demonstrate the commercial possibilities of the business. This demonstration having now been made, the time has arrived to formulate a plan for securing the requisite capital to at once start one or more stations in the upper part of the city. Preliminary canvasses and estimates have already been made, and, basing our opinion on the actual experience already had, we believe both of these proposed districts would pay satisfactory dividends upon the investment. We earnestly recommend your new board to give their earliest attention to this question of at once installing at least two large stations, one in what is known as the Madison Square district, and another in the best residence district, somewhere between Thirty-fourth street and Central Park.

Public attention is now being turned to the various methods of distributing electrical currents in the streets of large cities. Doubtless the entire success of our large system of underground conductors in this city during fifteen months of continuous use has helped to create the public conviction that there is no real necessity for overground conductors, and that all electrical currents can be distributed, as ours is, by underground methods. Mr. Edison foresaw from the start that public opinion would ultimately compel the removal of the visible nuisances of street poles and wires, and in perfecting his system of central station lighting, now so completely established, he not only adopted that kind of electric current which, being of low tension, is absolutely safe as regards fire and danger to the person, and capable of use under the ground, but also invented a full and complete system for conveying this current, like gas, under the streets. The existing general outcry against the danger and unsightliness of street poles and wires, with their attendant danger of high

pressure currents, is a striking confirmation of the foresight manifested by Mr. Edison in perfecting his underground system.

In closing this report, your board would again express to the stockholders their congratulations over the progress of the business during the year. The problem of central station lighting on a large scale, in which we have no competitor, is solved. Our company controls the exclusive license for this valuable system of lighting for all New York City, the most profitable field for electric lighting in the country, and it now rests with your new board of directors to devise means for occupying this rich territory."

ANNUAL MEETING OF THE ISOLATED COMPANY. DIRECTORS' REPORT. OFFICERS ELECTED. DIVIDEND DECLARED. The second annual meeting of the stockholders of the Edison Company for Isolated Lighting was held November 20th, 1883 at the office of the Company, No. 65 Fifth Avenue, New York City. The following are the officers and directors for the ensuing year: President, S. B. Eaton; Treasurer, F. S. Hastings; Secretary, J. Hutchinson; Directors: Thomas A. Edison, S. B. Eaton, Edward H. Johnson, C. H. Coster, Spencer Trask, J. C. Henderson, and Anthony J. Thomas.

The directors declared, January 8th, 1884, a dividend of 4 per centum payable January 28th, 1884.

The following is the Report of the Board of Directors submitted at the stockholders meeting, November 20th:

"*To the Stockholders of the Edison Company for Isolated Lighting:—*

This company has now been in existence two years, and your board are of opinion that the rapid and steady increase of its business, the perfection of the technical details connected with it, and the effectiveness of its executive and mechanical organization are all subjects for congratulation. Two years ago the company had but one size of dynamo, no reliable engine, no perfected appliances for installations, such as switches, safety-catches, sockets, fixtures, &c., and there were but eight isolated plants ordered, and only one or two in actual operation. The business was entirely new, there were no established methods, either mechanical or commercial, no trained workmen, everything was untried and in the future, and there was nothing in the past from which to draw experience. During the two years all this has been changed. Dynamos of many different sizes from 25 up to 1,000 lights, a reliable and satisfactory engine,

the innumerable mechanical details of installations, a complete business organization with competent superintendence and skilled workmen, are now at our command. The result of all this is seen in the development of our business.

The business of the company for the past year up to November 19th, has amounted to 138 installations of isolated plants aggregating 30,329 lamps. The installations of the previous year, ending November 19th, 1882, amounted to 137, with an aggregate of 25,426 lamps. The total business of the company, therefore, during the two years of its existence, aggregates 275 installations, with 55,755 lamps. These plants are principally in factories, although many of them are in stores, steamships, hotels and newspaper offices. The following table shows how steadily our business has grown from the start. The table gives the total number of separate plants that had been sold up to the several dates, the aggregate number of lamps composing them, and the average number of lamps for each plant.

Date.	Number of plants sold.	Aggregate number of lamps.	Average number of lamps per plant.
Feb. 1, 1882	36	5,122	142
July 1, "	[illegible]	10,358	150
Oct. 1, "	123	21,998	179
Dec. 1, "	153	29,192	191
Oct. 1, 1883	221	53,071	240
Nov. 19, "	275	55,755	203

Steamship lighting, although surrounded with peculiar difficulties, is a valuable adjunct to the company's business. Our large plant in the steamer *Pilgrim*, Fall River Line, finished since the last annual meeting, well illustrates our success in this class of installations. Among the steamboats now lighted by our isolated plants are the following, viz., the *Kate Adams*, Little Rock, Ark., 120 lamps; Mr. James Gordon Bennett's yacht, *Namouna*, 120 lamps; the steamers *Carolina* and *Virginia*, Baltimore, 120 lamps each; the *Pilgrim*, Fall River, 910 lamps; Mr. Jay Gould's yacht *Atalanta*, 116 lamps; the *City of Worcester*, New London, Conn., 300 lamps; the *Kalama*, Northern Pacific Railroad Company, 60 lamps; the steamships *Columbia*, 120 lamps, *Queen of the Pacific*, 250 lamps, *Alaskian*, 300 lamps, and *Olympia*, 300 lamps, all belonging to the Oregon Railway and Navigation Company; the steamships *Alemeda*, 210 lamps, *Mariposa*, 150 lamps, and *Kinau*, 100 lamps, all belonging to the Oceanic Steamship Company; the United States Fish Commission steamer, *Albatross*, 130 lamps; the *Trenton*, U. S. Navy, 150 lamps; and the ferryboats *Fanwood* and *Central*, 60 lamps each, belonging to the Central Railroad Company of New Jersey.

The lighting of newspaper offices is proving to be one of the best known branches of our business. At present our isolated plants are in use in the following offices, viz., the Baltimore *Sun*, the Boston *Advertiser*, the New York *Herald*, the Philadelphia *Ledger*, the Davenport *Gazette*, the Toronto *Mail*, the *Ohio State Journal*, Columbus, the Boston *Herald*, the Philadelphia *Record*, the Utica *Herald*, the Pittsburg *Times*, the Baltimore *Herald*, the Albany *Daily Press and Knickerbocker*, and the *Northern Budget* and *Troy Telegram*.

Reference was made in the last annual report to the lighting of villages and non-gas towns by small central station plants with aerial conductors, a system of lighting known in our business as Village Plants. As the Central Station business developed, Mr. Edison discovered that there was a vast number of towns and villages where, owing mainly to the fact that the houses were largely scattered, his system of distributing the current by underground conductors would be possibly too expensive. In order to meet the peculiar conditions of this large class of cases, and to meet the increasing demand for the light in villages, Mr. Edison has perfected a small and comparatively inexpensive method of central station lighting for towns not compactly built, where residences are widely distributed. This is called the Village Plant System, to distinguish it from the City Underground System, such as is now used in New York City, Lawrence and Brockton, and other cities both here and abroad.

These village systems, the current being distributed overground by means of pole lines, have proved entirely successful, and that branch of the Company's business is just beginning to be rapidly developed. This first installation of this kind was an experimental one, at Roselle, N. J., a non-gas town, made at the joint expense of this company and the Edison Electric Light Company. The plant was started last February, and has been in constant operation ever since, light being sold by meter measurement to most of the residences, and the streets lighted. Since that plant was installed the Light Company has made several other successful installations of these village plants, and, as a result of the success thus achieved, an active demand is now springing up for this system of artificial illumination. Thus far the demand has come principally from gas towns, but your board clearly see that during the coming year, as soon as these village plants are more generally introduced and understood, which is now being rapidly accomplished, a large demand will spring up also from non-gas towns. Under the contract between this company and the Edison Electric Light Company we control the introduction of the Edison electric light in all places where there are no gas companies; accordingly all such towns desiring village plants must apply to our company for a license. Within the past week a contract has been closed with one town of this description, Mount Carmel, Pa., which, being a non-gas town, has taken a license from, and pays a royalty to this company. Our policy in developing this branch of the business is to induce local householders who may become customers and use the light, to become subscribers to the stock of the local company. The Light Company practises the same policy. It has already been successfully inaugurated in several towns, and the success already accomplished indicates that during the coming year others of these companies

may thus be started. This branch of the business, from the necessities of the case, moves more slowly than that of selling isolated plants, but it absorbs none of our own capital, and our ultimate income from it may be large.

Our company has thus far parted with but little of its territory, still retaining nearly all that was originally secured by it from The Edison Electric Light Company. It may be of interest to state here just what this territory comprises. It is clearly set forth in the original contract between the Light Company and ourselves, viz.: All those portions of the United States and territories thereof which, on the first day of January, 1882, were included within the municipal limits of any town, city, village or other territorial municipality, wherein illuminating gas was not, or had not been, prior to that time, supplied for purposes of lighting to more than ten customers or consumers. In other words, our Company acquired all territory *outside* of gas limits. On the question of disposing of or selling out this territory, your present board have pursued the same general and conservative policy of the former board, and have deemed it best not to part with large areas of territory, certainly not until the business is more fully developed, and its real value more definitely known.

The last annual report called attention to the then existing necessity for increased capital. At that time the capital of the company was $500,000, of which 51 one-hundredths had been issued to the Edison Electric Light Company on account of a license, and the balance has been sold at par for cash, to raise money for carrying on the business. This amount of cash, however, had been found to be inadequate. Consequently, the necessity for increased capital having first been explained to the satisfaction of your board, the stockholders authorized an increase to $1,000,000, at a stockholders meeting held December 30th, 1882. Of this increase, 51 one-hundredths was issued to the Light Company, pursuant to the original contract, and of the balance of the increase only one-half, 50 per centum, of the par value, has as yet been called in. While the present cash capital is sufficient for the present requirements of the business, it is not enough to admit of all the orders being taken upon which good profits can be earned. Thi is especially true of one class of transactions, viz., lighting theatres and public buildings for a continuing compensation, by means of isolated plants owned and operated by this company. Several contracts of this sort, upon which good annual profits could be earned, have already been rejected by us, because they required the permanent investment of large sums, for which our capital was inadequate. The question of taking up this class of business and of calling in the unpaid instalments on the stock to furnish the requisite capital, will probably be one of the questions to be considered by your new board.

Regarding the more important details of the company's business, but little change has been made since the last annual meeting. The affairs of the company are still managed at the home office in New York City, local agents being employed throughout the country to solicit orders, and, except in most of New England and in the territory controlled by the Chicago company, viz., Illinois,

Iowa and Wisconsin, the installations are made from here. The established policy of conducting the business on a strictly one-price basis has been continued during the year. Some orders have been lost in consequence of adhering to this rule, but your board are strongly of the opinion that, on the whole, the business has been benefited by a rigid adherence to the one-price principle.

Everybody likes the Edison light and our method of installing it. Everywhere entire satisfaction is given by our plants. A large number of testimonials, relating both to the economy of our plants and the superiority of the light, have been received from our customers. They are altogether too numerous to be recited here, but most of them have been printed from time to time in the Bulletins, where doubtless our stockholders have seen them. But perhaps the best evidence of the satisfaction given by our plants is the fact that not a single one has ever been rejected on account of either economy, reliability or efficiency. On the other hand, many plants have been largely increased, after trial —a fact of peculiar interest as showing what our customers think of the light. There have been twenty-four increases of this kind, with an increase in the number of lamps from 3,275 to 8,165 lamps.

A noteworthy feature in the development of the business during the year is the income derived from lamp renewals. Every isolated plant consumes lamps, and a profit accrues to our company in supplying new ones. As our business grows and the aggregate number of lamps used in isolated plants increases, the supplying of new lamps becomes an important item.

The annual meeting of the stockholders is now held, pursuant to the by-laws of the company, "on the third Tuesday in November in each year." Our company was originally formed in the month of November, 1881, and the by-laws were adopted and the officers elected also in that month, which accounts for this date having been selected for the annual meeting. Experience has already shown that this date is an inconvenient and inappropriate one. Our main business, especially the selling of isolated plants, is done in the autumn, hence the annual meeting now takes place in the middle of the busiest part of the year. Not only is it difficult for the treasurer at that time to make up his annual statement, but, whenever it may be found necessary to change the officers of the company, the middle of the busy season will be likely to be an inopportune moment to do it. Consequently your board are of opinion that the time for the annual meeting should be changed, and the meeting take place in the dull season of the year, either in May or June. This is a matter which can be determined by the Board of Trustees, without any special action on the part of the stockholders; but inasmuch as a change of the date for holding the annual meeting might affect the time of declaring dividends, the subject may very properly be considered and acted upon by the shareholders at the present annual meeting.

An examination of the financial condition of the company, as shown by the Treasurer's Report submitted to the meeting herewith, shows that the finances of the company are in good condition. Whether it will be necessary to call in the

unpaid installments on the increased capital is a question left to your new board to determine. Probably it will not be necessary to do so, certainly for many months to come, unless the business of the company is developed in some new direction, notably that of leasing plants or selling the light to public buildings by means of plants owned by ourselves, a subject heretofore referred to in this report.

Although the volume of business the past year would probably have been larger, were it not for the fact that factories, our largest customers, have not made money, and have therefore not been willing to make large investments in electric light, nevertheless the growth of our business has been steady, as appears from the table submitted above. There appears to be no reason to doubt that this growth will be hereafter maintained, and that the business of the company may now be considered as established on a paying basis. The accomplishment of this result within a short period of two years, considering that the enterprise was entirely novel and utterly without precedent, is, in the judgment of your board, a cause for congratulation."

DEATHS FROM GAS. The following 22 recent deaths from illuminating gas have not been previously published in the *Bulletin* :

Name of Deceased.	Where Death Occurred.	Cause of Death.	Date
H. Greenberg	Hartmann's Hotel, N. Y. C.	Suffocation	1883. Oct. 17
Gustave Plunger	395 Bowery, N. Y. C.	"	" 17
Charles Kimmel	Baltimore, Md.	"	" 28
Dora Christenson	Chicago, Ills.	"	Nov. 3
Francis W. Martin	Sueblin's Hotel, Utica, N. Y.	"	" 14
Charles Meighem	Greason House, Washington	"	" 20
Albert G. Anderson	Reading, Pa.	"	"
Unknown	Bury, England	Explosion	" 24
John Palmer	Central Hotel, N. Y. C.	Suffocation	Dec. 3
George Morris	Baltimore, Md.	"	" 16
Hiram Ehrgood	Lackawanna Hosp'l Scranton.	"	" 19
John Walsh	" " "	"	" 19
John J. Culver	Gault House, Chicago.	"	" 30
Wallace Brookman	Ashland House, Lexington	"	1884. Feb 15
Richard Craig	" " "	"	" 15
George Hall	North River Hotel, N. Y. C.	"	" 18
Unknown	Frank's Hotel, N. Y. C.	"	" 23
Mrs. Lewis	New Haven, Conn.	"	Mch. 8
Miss Lewis	" " "	"	" 8
. P. Collins	Annex Hotel, Brooklyn, N. Y.	"	" 9
Joseph Carter	Van Dyke House, N. Y.	"	" 14
E. H. Gerster	Palmer House, Chicago	"	" 14

DANGER FROM GAS. Shortly after dark on August 23d, all the gas lights at West Brighton Beach, Coney Island, went out. An accident had happened to the holder which could not be repaired under 24 hours. * * * On August 24th a fire in the show window of Louis Albenberg's store at St. Paul was caused by goods coming in contact with a lighted gas jet. The contents of the window were destroyed and the plate glass broken. * * * Gas escaping from a main at Church Street, Toronto, August 31st, exploded, shaking the earth for some distance and injuring two men. * * * On September 19th, a fire occurred in the gas works at Keene, N. H. caused by an explosion of gas. A workman was injured, and the property was damaged to the extent of about $1,000. * * * A serious explosion of gas occurred at the Prefecture of Police, Boulevard du Palais, Paris, on September 30th. The earth was torn open and paving stones hurled to the third story windows. A policeman on duty at the gate was picked up in a dying condition, and three other persons were seriously injured, two of them, it was feared, fatally. * * * Escaping gas filled a street lamp at Shamokin, Pa., October 29th, and exploded when the lamp was lighted. The ignited gas ran down the post and under the pavement, which was torn up. * * * On November 11th a window curtain caught fire from a gas jet in the house of E. W. Levering, Baltimore, causing a fire which destroyed the building. * * * An explosion of gas occurred in one of the buildings of the gas company at Halifax N. S. on November 16th, causing much damage. * * * On November 17th a man named Kelly was asphyxiated in New York City by gas while making a joint between a building and the supply mains of the Gas Company. * * * A man named Foster took a naked light to find a gas leak at Jersey City, November 20th. An explosion occurred by which Foster was badly burned, and damage done to property. * * * Escaping gas at the Union Club House, Chicago,

on November 21st, caused an explosion and damage to the amount of $500. A watchman was burnt on the hands and face. * * * A boy carrying a basket of wool passed under a gas jet in the New Albany Cotton and Woolen Mills, at New Albany, Ind. November 21st. The wool caught fire from the gas and the mill was burned to the ground. The loss was $140,000. * * * Patrick Dodd and wife were asphyxiated by escaping gas in their room at the Pennsylvania House in New York City on November 22d. * * * An explosion of gas occurred November 28th, in the office of J. H. Fisher, Baltimore, shattering the windows and severely injuring a boy. * * * An explosion of escaping gas last November caused a fire in the show windows of the store of Rogers, Peet & Co., New York City. * * * On December 4th, Maggie Moran, a domestic in the family of J. B Barnes, Youngstown, Ohio, turned on a gas jet without lighting it, and forgot to turn it off. She was found insensible and was with difficulty restored to consciousness. * * * A gas meter exploded December 6th, in the packing house of John S. Mitchell, Baltimore, causing a fire. * * * Gas escaping from a leaky meter in Meyers' saloon, Chicago, December 7th, caught fire and exploded, blowing out the front windows of the saloon, and severely burning the proprietor. * * * On December 9th, a fire, originating from loose cotton coming in contact with a gas jet, destroyed the Annisquam Mill, Rockport, Mass. causing damage to the extent of $400,000. * * * Exploding gas in the cellar of the store of Likes, Berwanger & Co., Baltimore, caused a fire and damage of $200, December 11th. * * * A fire occurred December 12th in the "New York Store," Providence, caused by a lighted gas jet coming in contact with dry goods. Damage $50,000. * * * An explosion of gas occurred in the store of Charles S. Whitcomb, Chicago, December 22d, causing damage to the amount of about $1,000. The three front windows and the front door were

forced out of their frames and the store partially unroofed. Mr. Whitcomb was severely injured, sustaining a compound fracture of the right leg and other injuries. His clerk was also injured. * * * On December 24th, Sanford Sheridan and George Smith were found unconscious in bed at the Van Dyke House, New York City, the room being filled with illuminating gas. * * * A leaky gas pipe in a restaurant in Buffalo, caused an explosion, December 27th, whereby four persons were badly injured and the building and contents damaged. Loss $9,000. * * * On December 30th, Charles Neiman, Baltimore, was found insensible in his room, which was filled with escaping gas. * * * In December last an explosion of gas occurred at Pittsburg, Pa., whereby the stable of Schoeneberger & Co., was wrecked and four valuable horses and two mules were killed. The loss was estimated at $10,000. * * * Christine Ketswurm was found unconscious in bed at 215 Canal Street, New York City, January 6th, the room being filled with gas escaping from an unlighted burner. * * * Charles Kuhn was found unconscious in his room at the Van Dyke House, New York City, January 9th, the gas being turned on but not lighted. * * * A terrific gas explosion occurred in the building Nos. 157 to 161 Hanover Street, Boston, January 18th, whereby the whole structure was demolished, and adjoining property damaged. Two men were seriously injured by falling walls. A fire followed the explosion. The shock was felt for many blocks, and much damage was done to property in adjoining blocks. The damage was upwards of $61,000. * * * A young woman named Hansen, was found unconscious in her room at a hotel in Waterbury, Conn. January 29th, having blown out the gas when she retired the previous night. * * * A gas pipe which ran under a railway bridge at Springfield, Mass., burst on January 30th, and the sparks from a passing engine ignited the gas, setting fire to the bridge. * * * On February 14th the gas in some

portions of Baltimore was cut off, owing to accumulation of water in the mains. Many street lamps could not be lighted, and store-keepers had to resort to candles and lamps. * * * Levi Gottschalk was found unconscious in his room at Baltimore, February 14th, the room being filled with gas escaping from two unlighted burners. * * * A terrific explosion occurred in the vault of the Bank of Commerce at Toronto, Canada, on February 25th, caused by escaping gas. George Shaw, a messenger, was thrown a distance of twenty feet, and severely injured, twelve clerks where thrown down, and the paying teller was thrown through the window into the road, the iron doors of the vault were almost twisted off the hinges, and other damage was done. The damage was estimated at about $5,000. * * * An explosion of escaping gas occurred in the office of J. Harmanus Fisher & Sons, Baltimore, by which one man was injured and some property damaged. * * * Patrick Magher, an employee of the Waterbury (Conn.) Gas Co., was overcome by escaping gas while removing a gas meter. * * * Carl Witte, Henry Gilsick and Herman Leinester, were found unconscious in the room occupied by them at the College Place Hotel, New York City, March 11th, having been asphyxiated by escaping gas. They were removed to the hospital. * * * An explosion of gas in Hollender's restaurant, New York City, about March 12th, injured two men and caused damage to the amount of $500.

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END

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